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JULY 1969

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GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

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*Wolf Research and Development Corp., Riverdale, Md., under Contract NAS 5-9756.

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ABSTRACT

The resonance of GEOS-II (1968-002A) with 13th-order terms of the geopotential is analyzed. The odd-degree geopotential coefficients (13, 13), (15, 13), and (17, 13) given by Yionoulis most accurately model the resonance effects on GEOS-II of any of the published sets of 13th-order coefficients. However, this set is not adequate for precision orbit determination; additional even-degree coefficients are required.

Values of $C_{14,13}$ (= $.57 \times 10^{-21}$) and $S_{14,13}$ (= 6.5×10^{-21}) to be used with the odd-degree set of Yionoulis were obtained from an analysis of the observed along-track position variation of GEOS-II. These coefficients, when used with those of Yionoulis, yield greatly improved "fits" to the data and orbital prediction capability. However, further refinement may be possible because the small effects of the remaining even-degree resonant terms were not modeled.

The composite coefficients $C_{13,13}$ (= 1.7×10^{-20}) and $S_{13,13}$ (= $+2.7 \times 10^{-20}$) were obtained under the assumption that the (13, 13) spherical harmonic of the geopotential is responsible for all of the observed along-track variation of GEOS-II due to resonance. The good agreement of these deliberately composite values with some published values of $C_{13,13}$ and $S_{13,13}$ suggests that some of the published values may also be composite to a large extent.

Tables of eccentricity and inclination functions for resonance with 12th through 15th order terms are presented as an appendix.

CONTENTS

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INTRODUCTION

Definitive orbit determination for satellites must allow for the possibility of a resonance with longitude dependent terms in the geopotential. Kaula (Reference 1) notes that every satellite has some perturbations with a period of two or more days. For orbits of medium to high inclination, this will result in along-track oscillations of satellite motion of about 50-100 meters or more. Such a large effect is readily observable and must be modeled if high-quality determinations of orbit elements and other parameters are to be obtained.

The GEOS-II satellite has an unperturbed orbital frequency of about 12.82 cycles/day. Using the approximation that beat frequency = $\dot{M} - m\dot{\theta}$ where $\dot{M}$ is the orbital frequency of the satellite in revolutions per day, m is the order of the resonant geopotential coefficient and $\dot{\theta}$ is the rotation of the earth expressed in revolutions per day, the beat frequency is (12.82 - 13) = -0.18 cycles per day giving a beat period of more than 5.5 days. The total perturbation from the 13th-order terms amounts to nearly 600 meters along track. The published values of 13th-order coefficients most accurately modeling this effect are those published by Yionoulis* of the Applied Physics Laboratory (APL) (Reference 2). However, a residual along-track oscillation of about 150 m is still observed with these terms. Analysis indicates that even-degree 13th-order coefficients (not published by Yionoulis) are important. Provisional values of $C_{14,13}$ and $S_{14,13}$ have been obtained that remove essentially all of the remaining resonance effects for GEOS-II.

The low beat-period and eccentricity of GEOS-II make the effects of the resonant terms essentially indistinguishable from one another. We have obtained values of $C_{13,13}$ and $S_{13,13}$ that have absorbed the effects of all of the resonant terms. These composite coefficients have little meaning but agree well with some published values.

*These coefficients are hereinafter referred to as the APL coefficients.

STATUS OF DETERMINATIONS OF 13th-ORDER COEFFICIENTS

Table 1 gives the various published values of 13th-order geopotential coefficients. All are based on satellite data, with the Rapp and Köhnlein values also including gravimetric information.

Except for the APL and SAO-1969 coefficients, the values in Table 1 are very disparate. To illustrate the differences, Figures 1, 2, and 3 show plots of $C_{13,13}$, $S_{13,13}$, $C_{15,13}$, $S_{15,13}$, and $C_{17,13}$, $S_{17,13}$, respectively. Note that the agreement for the (13, 13), (15, 13), and (17, 13)

Table 1

Published Values for the 13th-Order Coefficients of the Model for the Geopotential.

Anderle (Reference 3)		Yionoulis (Reference 2)	Köhnlein (Reference 4)	Rapp (Reference 5)	SAO (1966) (Reference 6)	Kaula (Reference 7)	SAO (1969) (Reference 11)
$C^*_{13,13}$	$-.10 \times 10^{-19}$	$-.24 \times 10^{-19}$	$-.25 \times 10^{-19}$	$-.074 \times 10^{-19}$	$-.22 \times 10^{-19}$		$-.23 \times 10^{-19}$
$S_{13,13}$	$+.39 \times 10^{-19}$	$+.21 \times 10^{-19}$	0	$+.091 \times 10^{-19}$	$-.28 \times 10^{-19}$		$.23 \times 10^{-19}$
$C_{14,13}$			$+.073 \times 10^{-20}$	$+.14 \times 10^{-20}$			$.40 \times 10^{-20}$
$S_{14,13}$			$+.029 \times 10^{-20}$	$+.20 \times 10^{-20}$			$.52 \times 10^{-20}$
$C_{15,13}$	$-.11 \times 10^{-20}$	$-.077 \times 10^{-20}$	$+.10 \times 10^{-20}$		$-.012 \times 10^{-20}$	$-.06 \times 10^{-20}$	$-.07 \times 10^{-20}$
$S_{15,13}$	$-.10 \times 10^{-20}$	$-.037 \times 10^{-20}$	$-.06 \times 10^{-20}$		$-.093 \times 10^{-20}$	$-.14 \times 10^{-20}$	$-.02 \times 10^{-20}$
$C_{16,13}$							$.34 \times 10^{-21}$
$S_{16,13}$							$.42 \times 10^{-21}$
$C_{17,13}$		$+.16 \times 10^{-22}$					$.36 \times 10^{-22}$
$S_{17,13}$		$+.28 \times 10^{-22}$					$-.14 \times 10^{-22}$
$C_{18,13}$							$.88 \times 10^{-22}$
$S_{18,13}$							$.56 \times 10^{-22}$
$C_{19,13}$							$.06 \times 10^{-22}$
$S_{19,13}$							$-.25 \times 10^{-22}$
$C_{20,13}$							$.24 \times 10^{-22}$
$S_{20,13}$							$.20 \times 10^{-22}$
$C_{21,13}$							$-.34 \times 10^{-23}$
$S_{21,13}$							$-.16 \times 10^{-23}$

*Coefficients are presented in denormalized form. The denormalized coefficients are related to the normalized coefficients ($\bar{C}_{\ell,m}$, $\bar{S}_{\ell,m}$) as indicated below: $C_{\ell,m} = [(\ell - m)!\ (2\ell + 1)\ K/(\ell + m)!]^{1/2}\ \bar{C}_{\ell,m}$; and similarly for $S_{\ell,m}$, where k = 1 when m = 0, and k = 2 when m $\neq$ 0.

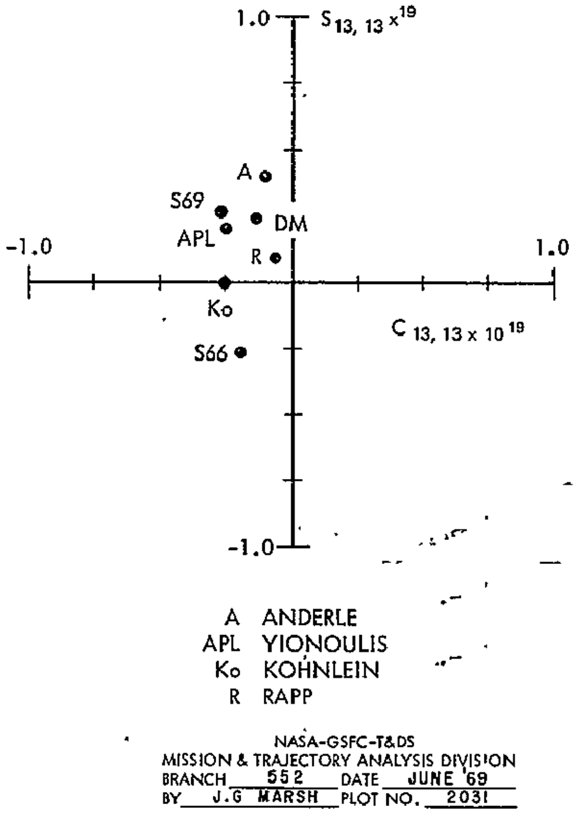

Figure 1—Plot of values for the (13, 13) coefficients for the model of the geopotential.

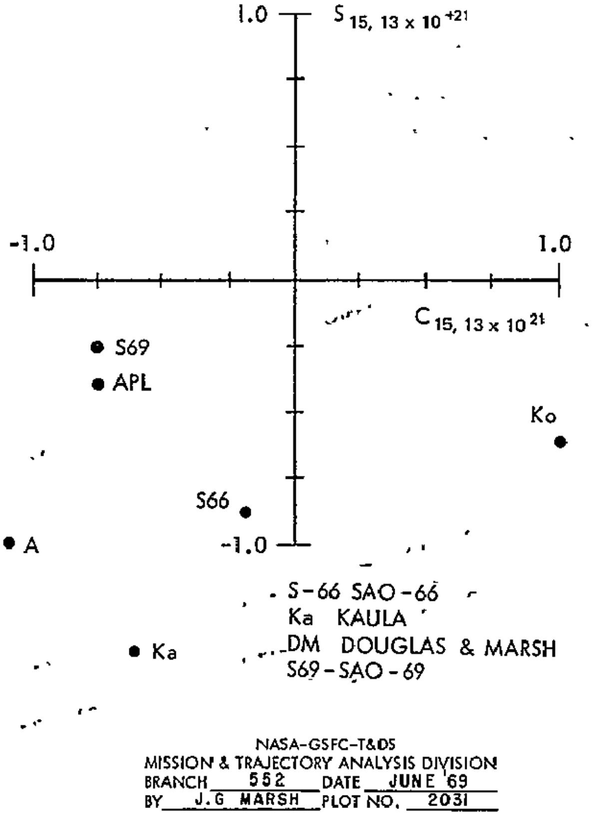

Figure 2—Plot of values for the (15, 13) coefficients for the model of the geopotential.

spherical harmonics is no more than an order of magnitude in amplitude $(J\ell, m)$ and not even nearest the quadrant in phase $(m\lambda\ell, m)$. This may seem surprising since the effects of the geopotential are so enhanced by resonance. However, even though resonance produces large effects on an orbit, the effects of individual terms are very hard to separate from each other. A recent study by Douglas et al. (Reference 8) indicates that for single resonant satellites or multiple satellites in the same or near the same orbit planes, the coefficients of the same order (m) are almost perfectly correlated with each other and/or the orbital period. Thus it is very difficult to obtain a truly general set of coefficients from observation of even several satellites on resonant orbits.

Seven sets of gravity coefficients were used in this study. The SAO M1 set (1966) (Reference 6) was derived in 1966 by the Smithsonian Astrophysical

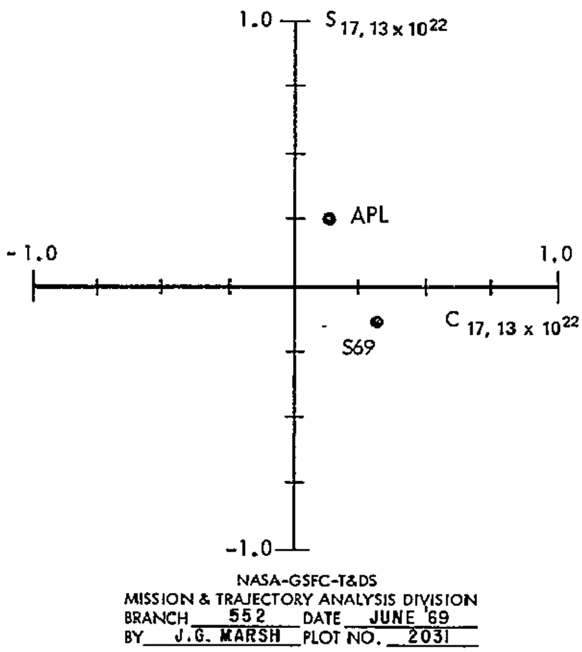

Figure 3—Plot of values for the (17, 13) coefficients for the model of the geopotential.

Observatory. This set was determined from precision reduced Baker-Nunn optical observations of 16 satellites. The set is complete up to 8, 8 (degree, order) with an additional 46 coefficients of higher degree making a total of 122 coefficients.

The APL 3.5 (Reference 10) set was derived from Tranet Doppler satellite observations by the Applied Physics Laboratory. This set is complete to (8, 8) with additional high degree coefficients making a total of 84 coefficients. The values for (13, 13), (15, 13) and (17, 13) were derived by Yionoulis (Reference 2) in an analysis of tracking data from three satellites after the APL 3.5 model was derived.

The NWL 5E-6 set (Reference 3) was derived by the Naval Weapons Laboratory also using Doppler data. This set is complete up to (7, 6) and has a total of 64 coefficients.

Kaula's set (Reference 7) was derived in 1967 from a combination of Doppler and optical observations of 12 satellites (7 optical, 5 Doppler). This set is complete to (7, 5) with additional higher degree coefficients.

The SAO (1969) model (Reference 11) is complete to (14, 14) with additional terms making a total of 260 coefficients. This set was derived from a combination of optical, Goddard Range and Range Rate and laser data from 24 satellites.

The following two sets were derived by combining terrestrial gravity measurements with the SAO M1 coefficients. Köhnlein's 1967 set (Reference 4), derived when he was associated with SAO, is complete to (15, 15) and Rapp's 1967 set (Reference 5) derived at the Ohio State University, is complete to (14, 14).

ANALYSIS OF RESONANT PERTURBATIONS

As noted, every satellite will have some terms with a period of at least two days. The case that minimizes resonance, an orbital frequency of $j + 1/2$ revs/day (where j is an integer) will have a beat frequency of $1/2$ day^{-1} with terms of order (m) j or $j + 1$. The beat period, the inverse of the beat frequency, is then ± 2 days.

Previously we noted that GEOS-II has a mean motion of slightly less than 13 revs/day. Including the effect of J_2, the beat period for the orbit is 6.7 days, resulting in large perturbations due to 13th-order terms. Table 2 shows the perturbations along-track that can be expected for this satellite if the normalized 13th-order coefficients follow the well-known rule

$$\overline{C}_{\ell m}, \overline{S}_{\ell m} = 10^{-5}/\ell^2 .$$

The ℓ, m quantities in Table 2 are the degree and order of a spherical harmonic. The p, q quantities are indices arising when the potential is expressed as a harmonic series in the Mean Anomaly of the satellite. Thus each spherical harmonic has a number of harmonic components

identified by the subscripts p, q. The harmonic series in mean anomaly for a spherical harmonic converges rapidly for low eccentricity (e) because the components contain a factor roughly proportional to $e^{|q|}$ for low e. Thus $|q|$ values higher than 1 are not important for GEOS-II. Note also that the $|q| = 1$ components are substantially smaller for GEOS-II than the components with $q = 0$. See Kaula (Reference 1) and Allan (Reference 9) for additional discussion.

Table 2 shows two important facts. First an extensive set of 13th-order coefficients is necessary to accurately model the resonance effects of GEOS-II. For this reason, the *partial* sets shown in the previous section could not be expected to produce highly accurate results. Also all of the resonant terms for GEOS-II have virtually the same beat period making it impossible to distinguish them from each other in a GEOS-II only orbital solution.

Table 3 shows the results of orbital solutions attempted for the various gravity models shown for a 5-day arc of MOTS camera data. The best orbital solution using published values was obtained with the SAO M1 gravity model using the APL odd degree 13th-order coefficients. Note that this solution is superior to the solution obtained with the SAO 1969 model in spite of the latters' extensive set of 13th-order coefficients. Also shown for some cases is the RMS value obtained for predicted observations covering a 4-day period subsequent to the 5-day arc. Note that prediction

Table 2

Perturbations of GEOS-II Due to 13th-Order Terms of the Geopotential.

ℓ m p q	Beat Period (days)	Along Track, Meters (with $\bar{C}_{\ell,m}$, $\bar{S}_{\ell,m} = 10^{-5}/\ell^2$)
13 13 6 0	-6.7	400
14 13 6 1	-6.5	60
14 13 7 1	-6.9	120
15 13 7 0	-6.7	350
16 13 7 1	-6.5	40
16 13 8 1	-6.9	20
17 13 8 0	-6.7	130
18 13 8 1	-6.5	30
18 13 9 1	-6.9	20
19 13 9 0	-6.7	10
20 13 9 1	-6.5	10
20 13 10 1	-6.9	20
21 13 10 0	-6.7	30
etc.		
Root Sum Square Value of all Resonant Terms		560 meters

Table 3

Gravity Model Comparisons Based Upon GEOS-II Orbital Solutions.

Coefficients	RMS (Secs. of Arc)	
	Orbital Solution 5 Days, 790 Obs.†	Prediction 4 Days, 290 Obs.‡
SAO M1 (1966)	12.6	
SAO M1 NO 13th*	20.3	
SAO M1 + APL 13th	6.4	38.5
APL 3.5 + APL 13th	8.4	39.8
NWL 5E 6	28.4	
NWL 5E 6 + APL 13th	11.9	48.7
Kaula	16.0	83.5
Kaula + APL 13th	10.1	39.0
Köhnlein	10.2	
Köhnlein + APL 13th	6.2	38.1
Rapp	12.8	
Rapp + APL 13th	8.1	32.1
SAO M1 + APL 13th + D & M (14, 13)	3.8	10.6
Köhnlein NO 13th	20.0	
Rapp NO 13th	21.0	
SAO 1969††	8.8	

*13th-order coefficients set equal to zero.
†April 29 to May 4, 1968.
‡May 5 to May 8, 1968.
††11th order coefficients set equal to zero - E. M. Gaposchkin has indicated that these terms should be ignored. (private communication)

accuracy suffers greatly when resonant terms are inadequately modeled. We did not try predictions with the SAO 1969 model because of the large RMS of fit obtained.

Table 3 also shows the partial success of the Rapp and Köhnlein values of 13th-order coefficients. These values remove much of the effect of the resonance. We believe that this fact represents a significant verification of partial success of gravimetric data in the determination of variations in the gravity field that are still of relatively long wavelength.

Figure 4 presents the results of an attempt to determine timing errors for the Goddard Range and Range Rate System (GRARR) using the SAO M1 gravity model plus the APL values of (13, 13), (15, 13) and (17, 13). GRARR residuals were computed about a five-day Minitrack Optical Tracking System (MOTS) reference orbit and a timing error was obtained for each pass. Although there is a large scatter, a sinusoidal variation with a period of about 6 days is discernable. Clearly only one pair of coefficients can be obtained, and these must be composite or "lumped" coefficients which have absorbed the effects of all of the neglected terms. We chose to solve for $C_{14,13}$ and

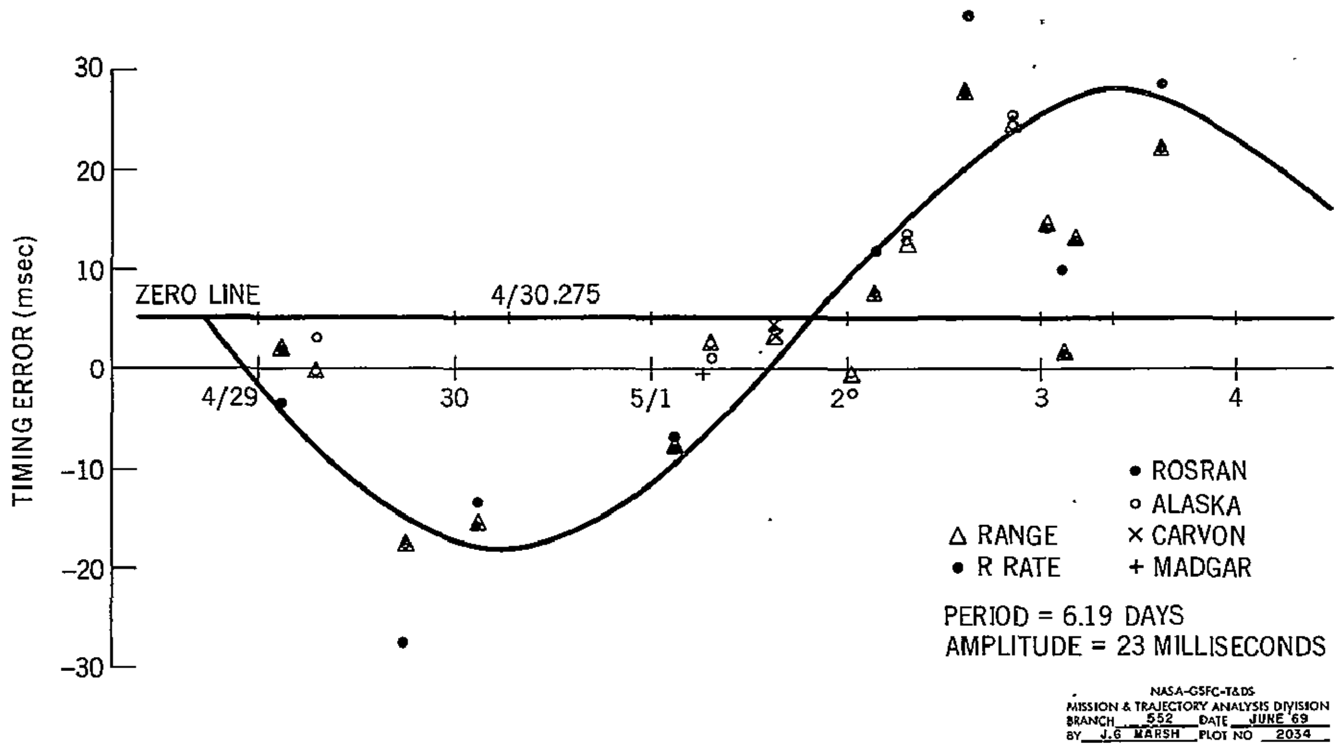

Figure 4—Apparent GEOS-II GRARR timing errors SAO M1 Gravity + APL 13th-order terms 4/29/68—5/4/68.

$S_{14,13}$, since from Table 2 we would expect the (14, 13) term to have by far the largest effect on this orbit of all of the even degree 13th-order coefficients.

The principal effect of resonance is along-track. This occurs because the greatest effect of resonance is to cause a long-period variation in orbital period. Mathematically, the large along-track effect is caused by terms with linear and quadratic small divisors in the expression for mean anomaly. For beat periods greater than 2 or 3 days the terms with quadratic small divisors dominate the solution. For the resonant (ℓ, m, p, q) components these terms have the form (Reference 1 or the Appendix):

$$\Delta M_{res(\ell mpq)} = \frac{3 a_e^{\ell} J_{\ell mp} F_{\ell mp}(i) G_{\ell pq}(e)(\ell - 2p + q)}{a^{\ell+3} \dot{D}_{\ell mpq}^2} \begin{bmatrix} \sin \\ -\cos \end{bmatrix}_{(\ell-m)\ \text{odd}}^{(\ell-m)\ \text{even}} D_{\ell mpq} \tag{1}$$

Where

$$D_{\ell mpq} = (\ell - 2p)\omega + (\ell - 2p + q)M + m(\Omega - \theta - \lambda_{\ell m}) \tag{2}$$

$$\dot{D}_{\ell mpq} = (\ell - 2p)\dot{\omega} + (\ell - 2p + q)\dot{M} + m(\dot{\Omega} - \dot{\theta}) \tag{3}$$

For circular or near circular orbits, a good estimate of the along-track position variation due to a resonant (ℓmpq) component is given by $a \cdot \Delta M$, where a is the orbital semi-major axis.

In considering a solution for $C_{14,13}$ and $S_{14,13}$, Table 2 shows that there are two important resonant (ℓ, m, p, q) components. These are

$$\ell mpq \;=\; 14,13,7,1 \quad \text{and} \quad 14,\ 13,\ 6,\ -1\ .$$

Using the formulae of Reference 1 or the tables in the Appendix for the $F_{\ell mp}(i)$ and $G_{\ell pq}(e)$ coefficients, and the orbital elements of GEOS-II on

April 28.739, 1968

a	7701.011 km
e	.0326147
i	105°.783
ω	353°.681
Ω	194°.817
M	121°.007

we obtain the following for the along-track variation, ΔL, produced by (14, 13) on GEOS-II:

$$\Delta L_{14,13} \;=\; .145\, J_{14,13} \Big\{ \big(.20 \times 10^{17}\big) \cos\big[M + 13(\Omega - \theta) - 13\lambda_{14,13}\big] + \big(.124 \times 10^{17}\big) \cos\big[2\omega + M + 13(\Omega - \theta) - 13\lambda_{14,13}\big]\Big\}\ . \tag{4}$$

Since $\dot{\omega}$ is small compared to $\dot{M} + 13\ (\dot{\Omega} - \dot{\theta})$, that is, 1°.6/day vs 60°/day, we shall ignore its variation for the 5-day arc of Figure 4 to combine the terms in ΔL as

$$\Delta L_{14,13} \;=\; .46 \times 10^{16}\, J_{14,13} \cos(x + \psi) \tag{5}$$

where

$$x \;=\; M + 13(\Omega - \theta) - 13\lambda_{14,13} \tag{6}$$

$\psi \approx$ 6°.5 for 2ω = 703°, the value near the middle of the arc.

From Figure 4, the satellite deviates about ±23 millisec. from the mean. The product of this figure and the satellite mean speed (about 6550 m/sec.) gives the approximate displacement along track equal to about 150 m or $2.4 \times 10^{-5}\ a_e$. A preliminary value of $J_{14,13}$ follows at once from Equation 5 as

$$J_{14,13} \sim 5.1 \times 10^{-21}$$

At the minimum displacement, $x + \psi = 180°$. This occurs as seen in Figure 4 at t = April 30.275 approximately. Using the elements at this date gives

$$13\lambda_{14,13} \approx 66° \;.$$

Preliminary values of $C_{14,13}$ and $S_{14,13}$ are thus

$$C_{14,13} = J_{14,13} \cos 13\lambda_{14,13} = 2.0 \times 10^{-21}$$

$$S_{14,13} = J_{14,13} \sin 13\lambda_{13,14} = 4.6 \times 10^{-21} \;.$$

These values were used with the APL odd-degree coefficients in another redetermination of apparent timing errors for the Rosman, North Carolina, observing site. This site was chosen for a refinement of the coefficients because its location is probably better determined than the others.

To remove the observed residual sinusoidal variation of apparent timing errors for Rosman it was necessary to increase $13\lambda_{14,13}$ by about 19° and to increase $J_{14,13}$ by about 1/3, yielding the improved values.

$$C_{14,13} = .57 \times 10^{-21}, \qquad S_{14,13} = 6.5 \times 10^{-21} \;.$$

In the determination of these values, it became obvious that the apparent constant bias of 5 millisec. in Figure 4 is spurious.

These values give excellent results, as can be seen from Table 3; however, further improvement in the determination of the (14, 13) values is possible since they have absorbed the effects of all of the unmodeled even-degree resonant terms as well as any errors in the odd-degree terms. The result is that the value of $J_{14,13}$ is probably too large by only a small factor, since the total effect of all of the resonant terms is near their root-sum-of-squares and (14, 13) has by far the largest effect of the terms not reported by Yionoulis. The effect of the neglected terms on $13\lambda_{14,13}$ is random, but the quadrant of $13\lambda_{14,13}$ is likely correct again because (14, 13) should be dominant among even-degree terms. Figure 5 compares our values with those of Rapp, Köhnlein, and SAO 1969. The agreement in phase angle is good. The magnitudes are very disparate between the dynamic and combined dynamic-gravimetric determinations.

Figure 6 shows the apparent timing errors for Rosman ranges using the improved values. If the low elevation passes are excluded, it will be seen that the apparent timing errors lies along a nearly straight line with small slope. This deviation could not be attributed to unaccounted-for resonance effects. This apparent secular effect is only about ±3 millisec. (about 20 meters) over the 6-day period shown, an amount that is tolerable for activities (such as station position determinations) that use arcs of 1 to 2 days.

Composite values of $C_{13,13}$ and $S_{13,13}$ were also determined. Figure 7 shows the apparent GRARR Range timing errors when no 13th-order coefficients are included in the MOTS camera

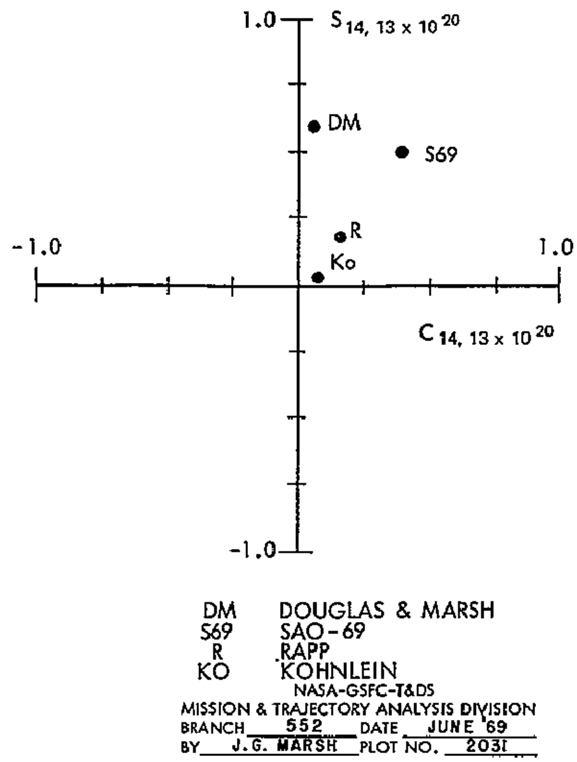

Figure 5—Plot of values for the (14, 13) coefficients for the model of the geopotential.

data solution. It is obvious that attribution of the along-track displacement to more than one spherical harmonic will be very difficult. If we assume (13, 13) to be responsible, the dominant component of (13, 13) is

$$\ell, m, p, q = 13, 13, 6, 0$$

Applying Equation (1), we obtained the preliminary values

$$C_{13,13} = -1.7 \times 10^{-20}$$

$$S_{13,13} = +2.7 \times 10^{-20}$$

The good agreement of these deliberately composite or "lumped" values (Figure 1) with some of the published values strongly suggests that many of the published values are also composite to a large extent.

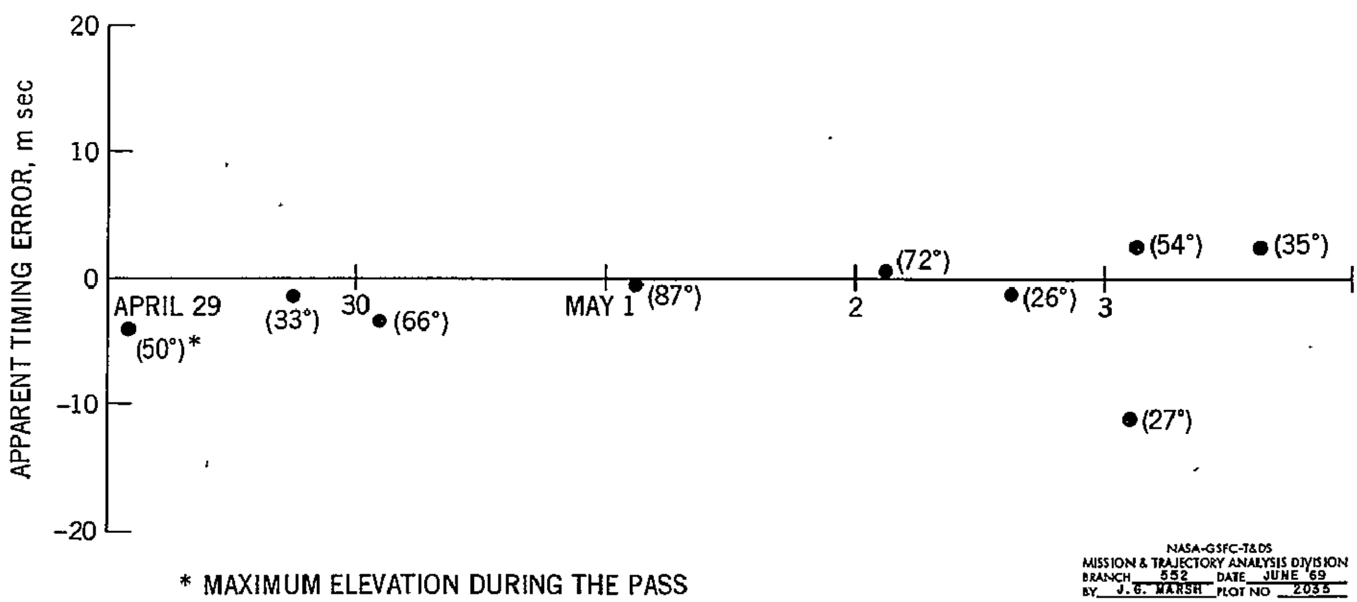

Figure 6—Apparent ROSMAN range timing errors with SAO M1 gravity, APL 13th-order coefficients and $C_{14,13} = .57 \times 10^{-21}$, $S_{14,13} = 6.5 \times 10^{-21}$ 4/29/68 to 5/4/68.

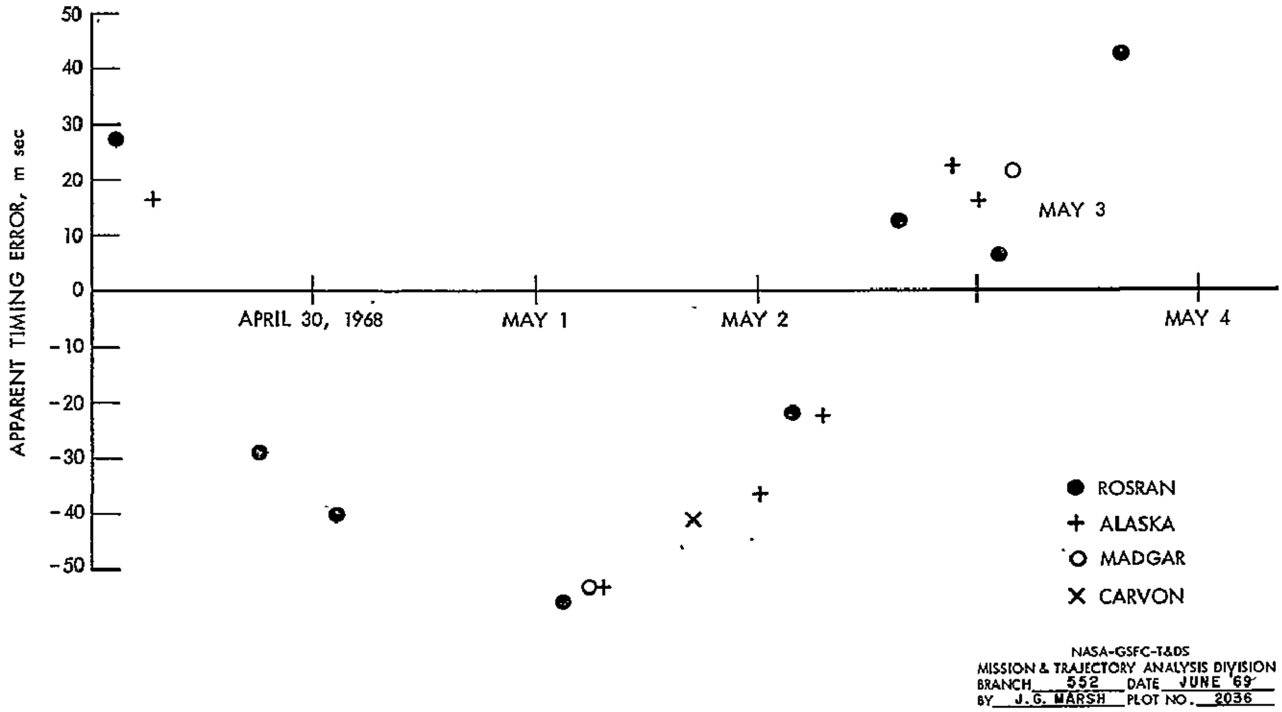

Figure 7—Apparent GRARR range timing errors with SAO M1 gravity and no resonant terms.

CONCLUSION

We conclude that resonance is likely to be a serious problem for precision orbit determination for low altitude satellites such as GEOS-II. In the specific case of GEOS-II, it was found necessary to refine published values of 13th-order coefficients to obtain accurate results. Because of the apparent difficulty in obtaining accurate estimates of high order coefficients from resonant orbits or gravimetry, accurate analysis of specific orbits probably requires a solution for one or more resonant coefficients simultaneously with the orbit elements and other parameters of the problem.

ACKNOWLEDGMENTS

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REFERENCES

1. Kaula, W. M., Theory of Satellite Geodesy, Blaisdell, Waltham, Massachusetts, 1966.

2. Yionoulis, S. M., "Improved Coefficients of the Thirteenth-Order Harmonics of the Geopotential Derived from Satellite Doppler Data at Three Different Orbital Inclinations," John Hopkins/Applied Physics Laboratory Report TG-1003, May 1968.

3. Anderle, R., "Observations of Resonance Effects on Satellite Orbits Arising from the Thirteenth- and Fourteenth-Order Tesseral Gravitational Coefficients," Journal of Geophysical Research, 70, 10, May 15, 1965.

4. Köhnlein, W., "The Earth's Gravitational Field as Derived from a Combination of Satellite Data with Gravity Anomalies," prepared for the XIV General Assembly International Union of Geodesy and Geophysics, International Association of Geodesy, Lucerne, Switzerland, October 1967.

5. Rapp, R. H., "The Geopotential to (14, 14) from a combination of Satellite and Gravimetric Data," presented at the XIV General Assembly International Union of Geodesy and Geophysics, International Association of Geodesy, Lucerne, Switzerland, October 1967.

6. Lundquist, C. A., and Veis, G., "Geodetic Parameters for a 1966 Smithsonian Institute Standard Earth," Smothsonian Astrophysical Observatory Special Report No. 200, Vol. 1, 1966.

7. Kaula, W. M., "Analysis of Geodetic Satellite Tracking Data to Determine Tesseral Harmonics of the Earth's Gravitational Field," final report NASA Contract No. NSR 05-007-060, 1968.

8. Douglas, B. C., Martin, C. F., Wagner, C. A., and Williamson, R. G., "Error Analyses of Resonant Orbits," NASA Document No. X-552-69-92, March 1969.

9. Allan, R. R., "Satellite Resonance with Longitude Dependent Gravity-II Effects Involving the Eccentricity," *Planetary and Space Science 15,* pp. 1829-1845, 1967.

10. Guier, W. H., and Newton, R. R., "The Earth's Gravitational Field as Deduced from the Doppler Tracking of Five Satellites," Journal of Geophysical Research, Vol. 70, No. 18, September 1965.

11. Gaposchkin, E. M., "Improved Values for the Tesseral Harmonics of the Geopotential and Station Coordinates," Smithsonian Astrophysical Observatory Paper presented at the XII Meeting of COSPAR, Prague, Czechoslovakia, May 1969.

Appendix

Tables of Inclination and Eccentricity Functions for Low Altitude Resonant Orbits

According to Reference 1, the resonant (ℓ, m, p, q) sets are those for which $\dot{D}_{\ell mpq}$ is zero or small, i.e.,

$$\dot{D}_{\ell mpq} = (\ell - 2p)\,\dot{\omega} + (\ell - 2p + q)\,\dot{M} + m(\dot{\Omega} - \dot{\theta}) \approx 0 . \tag{A1}$$

Since $\dot{\omega}$ and $\dot{\Omega}$ are always small compared to $\dot{M}$ or $\dot{\theta}$, Equation A1 will be fulfilled when

$$(\ell - 2p + q)\,\dot{M} \approx m\,\dot{\theta} \tag{A2}$$

or, setting

$$\dot{M} = s \text{ revs/day} ,$$

$$\dot{\theta} = 1 \text{ rev/day} ,$$

then

$$\ell - 2p + q = \frac{m}{s} . \tag{A3}$$

It is from Equation A3 that the resonant (ℓ, m, p, q) sets are obtained. For example, for GEOS-II

13, 13, 6, 0
: : : :
13, 13, 7, −2
:
14, 13, 6, −1
:
15, 13, 7, 0

etc.

The sets indicated are for $m/s = 1$. Values for $m/s = 2$ give resonances with 26th order terms, but these 2nd order resonances are not important unless the resonance is very deep.

For the beat periods usually encountered with low altitude satellites, the formulae for the perturbations of the elements given by Kaula (Reference 1) are adequate. These are

$$\Delta a_{\ell mpq} = \mu a_e^{\ell} \frac{2F_{\ell mp} G_{\ell pq} (\ell - 2p + q) S_{\ell mpq}}{na^{\ell+2}\left[(\ell - 2p)\dot{\omega} + (\ell - 2p + q)\dot{M} + m(\dot{\Omega} - \dot{\theta})\right]} ,$$

$$\Delta e_{\ell mpq} = \mu a_e^{\ell} \frac{F_{\ell mp} G_{\ell pq} (1 - e^2)^{1/2} \left[(1 - e^2)^{1/2} (\ell - 2p + q) - (\ell - 2p)\right] S_{\ell mpq}}{na^{\ell+3} e\left[(\ell - 2p)\dot{\omega} + (\ell - 2p + q)\dot{M} + m(\dot{\Omega} - \dot{\theta})\right]} ,$$

$$\Delta \omega_{\ell mpq} = \mu a_e^{\ell} \frac{\left[(1 - e^2)^{1/2} e^{-1} F_{\ell mp} (\partial G_{\ell pq}/\partial e) - \cot i (1 - e^2)^{-1/2} (\partial F_{\ell mp}/\partial i) G_{\ell pq}\right] \overline{S}_{\ell mpq}}{na^{\ell+3}\left[(\ell - 2p)\dot{\omega} + (\ell - 2p + p)\dot{M} + m(\dot{\Omega} - \dot{\theta})\right]} ,$$

$$\Delta i_{\ell mpq} = \mu a_e^{\ell} \frac{F_{\ell mp} G_{\ell pq} \left[(\ell - 2p) \cos i - m\right] S_{\ell mpq}}{na^{\ell+3} (1 - e^2)^{1/2} \sin i \left[(\ell - 2p)\dot{\omega} + (\ell - 2p + q)\dot{M} + m(\dot{\Omega} - \dot{\theta})\right]} ,$$

$$\Delta \Omega_{\ell mpq} = \mu a_e^{\ell} \frac{(\partial F_{\ell mp}/\partial i) G_{\ell pq} \overline{S}_{\ell mpq}}{na^{\ell+3} (1 - e^2)^{1/2} \sin i \left[(\ell - 2p)\dot{\omega} + (\ell - 2p + q)\dot{M} + m(\dot{\Omega} - \dot{\theta})\right]} ,$$

$$\Delta M_{\ell mpq} = \mu a_e^{\ell} \frac{\left[-(1 - e^2) e^{-1} (\partial G_{\ell pq}/\partial e) + 2(\ell + 1) G_{\ell pq}\right] F_{\ell mp} \overline{S}_{\ell mpq}}{na^{\ell+3}\left[(\ell - 2p)\dot{\omega} + (\ell - 2p + q)\dot{M} + m(\dot{\Omega} - \dot{\theta})\right]} +$$

$$- \frac{3\mu a_e^{\ell} F_{\ell mp} G_{\ell mp} \overline{S}_{\ell mpq} (\ell - 2p + q)}{a^{\ell+3}\left[(\ell - 2p)\dot{\omega} + (\ell - 2p + q)\dot{M} + m(\Omega - \theta)\right]^2} .$$

The quantity $\overline{S}_{\ell mpq}$ is the integral of $S_{\ell mpq}$ with respect to its argument, where

$$S_{\ell mpq} = J_{\ell m} \begin{bmatrix} \cos \\ \sin \end{bmatrix}^{(\ell - m)\text{even}}_{(\ell - m)\text{odd}} \left\{(\ell - 2p)\omega + (\ell - 2p + q) M + m(\Omega - \theta - \lambda_{\ell m}\right) ,$$

and

$$C_{\ell m} = J_{\ell m} \cos m \lambda_{\ell m}$$

$$S_{\ell m} = J_{\ell m} \sin m \lambda_{\ell m} .$$

For beat periods greater than about 50-75 days, these formulae will be increasingly inaccurate and should be used carefully if at all.

In Equations A4 - A9, there is only one term likely to be of considerable significance. This is the 2nd term of $\Delta M_{\ell mpq}$. It contains the square of the beat frequency $\dot{D}_{\ell mpq}$ as a denominator. Thus, a good estimate of along track displacement can be obtained from $a \cdot \Delta M$ for cases with beat period > 2 days or so using only the second term of ΔM.

The most difficult aspect of using Equations A4 through A9 is obtaining the values of the F&G coefficients or their derivatives. To this end, tables have been prepared that will yield values of the functions and their 1st derivatives to 2 significant figures over a large range of eccentricity and inclination. The coefficients needed for calculation of the effects of the principal even and odd degree geopotential coefficients only are given.

The tables are not constructed with evenly spaced tabular intervals. Rather they were constructed to permit use of Taylor's expansion for nontabular entries. To illustrate the use of the tables, consider the calculation of $F_{14,13,6}$ (105°.8), needed for GEOS-II. First, locate the appropriate interval in the table, in this case the interval between 104° and 106° (XLO and XHI in the tables). We expand about XMID, in this case, 105°, yielding

$$
\begin{aligned}
F_{14,13,6}(105^\circ.8) &= F_{14,13,6}(105^\circ) + (.8/57.3)\left(.186 \times 10^{14}\right) \\
&= \left(.59 \times 10^{13}\right) + (.8/57.3)\left(.186 \times 10^{14}\right) \\
&= .56 \times 10^{13} .
\end{aligned}
$$

Note that the incremental angle for XMID must be converted to radians. Higher accuracy can be obtained by using the 2nd derivative also, but this will seldom be justified. The use of the tables of eccentricity functions is entirely similar, except that no conversion of the incremental eccentricity from the value at XMID is required.

References

1. Kaula, W. M., Theory of Satellite Geodesy, Blaisdell, Watham, Massachusetts, 1966.

Definition of Symbols Used in Table A1

XLO - Lower value of satellite orbital inclination.

XMID - Middle value of satellite orbital inclination.

XHI - Higher value of satellite orbital inclination.

FXMID - Value of the inclination function corresponding to the middle value of inclination.

DFXMID - Value of the first derivative of the inclination function corresponding to the middle value of inclination.

DDFXMID - Value of the second derivative of the inclination function corresponding to the middle value of inclination.

Table A1

Tables of Inclination Function Coefficients for Calculation of the Effects of the Principal Even and Odd Geopotential Coefficients.

EVALUATION OF INCLINATION FUNCTION FOR L=12 M=12 P= 5

XLO*	XMID*	XHI*	FXMID	DFXMID	DDFXMID
30.00	30.50	31.00	0.240D 09	0.395D 10	0.553D 11
31.00	31.50	32.00	0.318D 09	0.501D 10	0.670D 11
32.00	32.50	33.00	0.417D 09	0.630D 10	0.803D 11
33.00	33.50	34.00	0.540D 09	0.783D 10	0.952D 11
34.00	34.50	35.00	0.691D 09	0.963D 10	0.112D 12
35.00	35.50	36.00	0.877D 09	0.117D 11	0.130D 12
36.00	36.50	37.00	0.110D 10	0.142D 11	0.150D 12
37.00	37.50	38.00	0.137D 10	0.179D 11	0.171D 12
38.00	38.50	39.00	0.170D 10	0.202D 11	0.194D 12
39.00	40.00	41.00	0.230D 10	0.257D 11	0.229D 12
41.00	42.00	43.00	0.334D 10	0.346D 11	0.279D 12
43.00	44.00	45.00	0.473D 10	0.452D 11	0.328D 12
45.00	46.00	48.00	0.651D 10	0.574D 11	0.372D 12
48.00	53.00	56.00	0.166D 11	0.108D 12	0.428D 12
56.00	58.00	60.00	0.275D 11	0.142D 12	0.309D 12
60.00	61.00	62.00	0.353D 11	0.154D 12	0.164D 12
62.00	63.00	64.00	0.408D 11	0.158D 12	0.409D 11
64.00	65.00	66.00	0.463D 11	0.157D 12	-0.970D 11
66.00	67.00	68.00	0.517D 11	0.151D 12	-0.243D 12
68.00	69.00	70.00	0.567D 11	0.140D 12	-0.390D 12
70.00	71.00	72.00	0.614D 11	0.124D 12	-0.529D 12
72.00	73.00	74.00	0.653D 11	0.103D 12	-0.653D 12
74.00	75.00	76.00	0.685D 11	0.784D 11	-0.753D 12
76.00	77.00	78.00	0.708D 11	0.508D 11	-0.825D 12
78.00	81.00	82.00	0.722D 11	-0.898D 10	-0.864D 12
82.00	83.00	84.00	0.714D 11	-0.387D 11	-0.831D 12
84.00	85.00	86.00	0.696D 11	-0.666D 11	-0.765D 12
86.00	87.00	88.00	0.668D 11	-0.918D 11	-0.671D 12
88.00	89.00	90.00	0.632D 11	-0.113D 12	-0.554D 12
90.00	91.00	92.00	0.589D 11	-0.130D 12	-0.422D 12
92.00	93.00	94.00	0.542D 11	-0.143D 12	-0.262D 12
94.00	95.00	96.00	0.490D 11	-0.150D 12	-0.143D 12
96.00	97.00	98.00	0.438D 11	-0.153D 12	-0.113D 11
98.00	99.00	100.00	0.384D 11	-0.151D 12	0.107D 12
100.00	101.00	102.00	0.333D 11	-0.145D 12	0.208D 12
102.00	104.00	106.00	0.260D 11	-0.131D 12	0.319D 12
106.00	111.00	111.00	0.127D 11	-0.854D 11	0.392D 12

*Values of inclination in degrees.

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=12 M=12 P= 6

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.25	30.50	0.191D 08	0.392D 09	0.717D 10
30.50	30.75	31.00	0.228D 08	0.459D 09	0.822D 10
31.00	31.25	31.50	0.271D 08	0.536D 09	0.939D 10
31.50	31.75	32.00	0.322D 08	0.624D 09	0.107D 11
32.00	32.25	32.50	0.380D 08	0.723D 09	0.122D 11
32.50	33.00	33.50	0.486D 08	0.898D 09	0.146D 11
33.50	34.00	34.50	0.667D 08	0.119D 10	0.185D 11
34.50	35.00	35.50	0.905D 08	0.155D 10	0.233D 11
35.50	36.00	36.50	0.121D 09	0.200D 10	0.289D 11
36.50	37.00	37.50	0.161D 09	0.256D 10	0.355D 11
37.50	38.00	38.50	0.212D 09	0.325D 10	0.432D 11
38.50	39.00	39.50	0.275D 09	0.408D 10	0.521D 11
39.50	40.00	40.50	0.355D 09	0.508D 10	0.623D 11
40.50	41.00	41.50	0.454D 09	0.626D 10	0.738D 11
41.50	42.00	42.50	0.575D 09	0.766D 10	0.867D 11
42.50	43.00	43.50	0.722D 09	0.929D 10	0.101D 12
43.50	44.00	44.50	0.901D 09	0.112D 11	0.117D 12
44.50	45.00	45.50	0.111D 10	0.134D 11	0.134D 12
45.50	46.00	47.00	0.137D 10	0.159D 11	0.152D 12
47.00	48.00	49.00	0.202D 10	0.219D 11	0.192D 12
49.00	50.00	51.00	0.291D 10	0.293D 11	0.236D 12
51.00	52.00	53.00	0.409D 10	0.383D 11	0.280D 12
53.00	54.00	55.00	0.561D 10	0.489D 11	0.323D 12
55.00	56.00	58.00	0.752D 10	0.609D 11	0.361D 12
58.00	63.00	66.00	0.179D 11	0.109D 12	0.398D 12
66.00	68.00	69.00	0.288D 11	0.140D 12	0.275D 12
69.00	70.00	71.00	0.338D 11	0.148D 12	0.186D 12
71.00	72.00	73.00	0.391D 11	0.152D 12	0.756D 11
73.00	74.00	75.00	0.444D 11	0.153D 12	-0.509D 11
75.00	76.00	77.00	0.497D 11	0.149D 12	-0.188D 12
77.00	78.00	79.00	0.547D 11	0.140D 12	-0.330D 12
79.00	80.00	81.00	0.594D 11	0.126D 12	-0.469D 12
81.00	82.00	83.00	0.634D 11	0.107D 12	-0.596D 12
83.00	84.00	85.00	0.668D 11	0.842D 11	-0.704D 12
85.00	86.00	87.00	0.693D 11	0.581D 11	-0.787D 12
87.00	88.00	89.00	0.708D 11	0.297D 11	-0.838D 12
89.00	91.00	92.00	0.712D 11	-0.149D 11	-0.852D 12
92.00	93.00	94.00	0.702D 11	-0.441D 11	-0.817D 12
94.00	95.00	96.00	0.681D 11	-0.715D 11	-0.749D 12
96.00	97.00	98.00	0.652D 11	-0.961D 11	-0.653D 12
98.00	99.00	100.00	0.615D 11	-0.117D 12	-0.534D 12
100.00	101.00	102.00	0.571D 11	-0.133D 12	-0.400D 12
102.00	103.00	104.00	0.522D 11	-0.145D 12	-0.259D 12
104.00	105.00	106.00	0.471D 11	-0.151D 12	-0.119D 12
106.00	107.00	108.00	0.417D 11	-0.153D 12	0.141D 11
108.00	109.00	110.00	0.364D 11	-0.150D 12	0.133D 12
110.00	111.00	111.00	0.313D 11	-0.144D 12	0.233D 12

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=13 M=12 P= 5

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.50	31.00	-0.113D 11	-0.154D 12	-0.167D 13
31.00	31.50	32.00	-0.143D 11	-0.185D 12	-0.189D 13
32.00	33.00	34.00	-0.198D 11	-0.239D 12	-0.221D 13
34.00	35.00	36.00	-0.296D 11	-0.323D 12	-0.261D 13
36.00	37.00	39.00	-0.425D 11	-0.420D 12	-0.291D 13
39.00	41.00	43.00	-0.792D 11	-0.632D 12	-0.301D 13
43.00	44.00	45.00	-0.116D 12	-0.777D 12	-0.242D 13
45.00	46.00	47.00	-0.145D 12	-0.848D 12	-0.164D 13
47.00	48.00	49.00	-0.175D 12	-0.888D 12	-0.567D 12
49.00	50.00	51.00	-0.206D 12	-0.885D 12	0.772D 12
51.00	52.00	53.00	-0.236D 12	-0.832D 12	0.230D 13
53.00	54.00	54.50	-0.264D 12	-0.723D 12	0.392D 13
54.50	55.00	55.50	-0.276D 12	-0.648D 12	0.473D 13
55.50	56.00	56.50	-0.286D 12	-0.558D 12	0.552D 13
56.50	57.00	57.50	-0.295D 12	-0.455D 12	0.626D 13
57.50	58.00	58.50	-0.302D 12	-0.340D 12	0.695D 13
58.50	59.00	59.50	-0.307D 12	-0.213D 12	0.756D 13
59.50	60.00	60.25	-0.309D 12	-0.765D 11	0.808D 13
60.25	60.50	60.75	-0.310D 12	-0.497D 10	0.831D 13
60.75	61.00	61.50	-0.309D 12	0.684D 11	0.851D 13
61.50	62.00	63.00	-0.307D 12	0.220D 12	0.881D 13
63.00	65.00	67.00	-0.283D 12	0.690D 12	0.896D 13
67.00	68.00	69.00	-0.235D 12	0.114D 13	0.786D 13
69.00	70.00	71.00	-0.191D 12	0.139D 13	0.648D 13
71.00	72.00	73.00	-0.139D 12	0.158D 13	0.468D 13
73.00	74.00	75.00	-0.811D 11	0.171D 13	0.258D 13
75.00	76.00	77.00	-0.202D 11	0.176D 13	0.329D 12
77.00	78.00	79.00	0.410D 11	0.173D 13	-0.192D 13
79.00	80.00	81.00	0.999D 11	0.163D 13	-0.400D 13
81.00	82.00	83.00	0.154D 12	0.146D 13	-0.578D 13
83.00	84.00	85.00	0.201D 12	0.123D 13	-0.715D 13
85.00	87.00	89.00	0.255D 12	0.822D 12	-0.830D 13
89.00	90.00	91.00	0.287D 12	0.382D 12	-0.831D 13
91.00	91.50	92.00	0.294D 12	0.169D 12	-0.793D 13
92.00	92.50	92.62	0.296D 12	0.338D 11	-0.755D 13
92.62	92.75	93.00	0.296D 12	0.103D 10	-0.745D 13
93.00	93.25	93.50	0.295D 12	-0.630D 11	-0.721D 13
93.50	93.75	94.00	0.295D 12	-0.125D 12	-0.696D 13
94.00	94.50	95.00	0.292D 12	-0.213D 12	-0.656D 13
95.00	95.50	96.00	0.288D 12	-0.323D 12	-0.596D 13
96.00	96.50	97.00	0.281D 12	-0.421D 12	-0.532D 13
97.00	97.50	98.00	0.273D 12	-0.508D 12	-0.465D 13
98.00	98.50	99.00	0.263D 12	-0.583D 12	-0.396D 13
99.00	100.00	101.00	0.247D 12	-0.673D 12	-0.292D 13
101.00	102.00	103.00	0.222D 12	-0.752D 12	-0.159D 13
103.00	104.00	105.00	0.195D 12	-0.786D 12	-0.389D 12
105.00	106.00	107.00	0.168D 12	-0.781D 12	0.623D 12
107.00	108.00	109.00	0.141D 12	-0.745D 12	0.141D 13
109.00	111.00	111.00	0.104D 12	-0.649D 12	0.216D 13

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=13 M=12 P= 6

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.50	31.00	-0.139D 10	-0.247D 11	-0.377D 12
31.00	31.50	32.00	-0.189D 10	-0.320D 11	-0.465D 12
32.00	32.50	33.00	-0.252D 10	-0.410D 11	-0.566D 12
33.00	33.50	34.00	-0.333D 10	-0.519D 11	-0.682D 12
34.00	34.50	35.00	-0.434D 10	-0.649D 11	-0.812D 12
35.00	35.50	36.00	-0.561D 10	-0.803D 11	-0.953D 12
36.00	36.50	37.00	-0.716D 10	-0.982D 11	-0.111D 13
37.00	37.50	38.00	-0.905D 10	-0.119D 12	-0.127D 13
38.00	38.50	39.00	-0.113D 11	-0.143D 12	-0.145D 13
39.00	39.50	40.00	-0.141D 11	-0.170D 12	-0.163D 13
40.00	41.00	42.00	-0.191D 11	-0.216D 12	-0.190D 13
42.00	43.00	44.00	-0.279D 11	-0.289D 12	-0.225D 13
44.00	45.00	47.00	-0.394D 11	-0.373D 12	-0.254D 13
47.00	50.00	52.00	-0.821D 11	-0.608D 12	-0.267D 13
52.00	53.00	54.00	-0.117D 12	-0.736D 12	-0.211D 13
54.00	55.00	56.00	-0.144D 12	-0.798D 12	-0.140D 13
56.00	57.00	58.00	-0.173D 12	-0.830D 12	-0.422D 12
58.00	59.00	60.00	-0.202D 12	-0.825D 12	0.793D 12
60.00	61.00	62.00	-0.230D 12	-0.773D 12	0.219D 13
62.00	63.00	63.50	-0.255D 12	-0.671D 12	0.368D 13
63.50	64.00	64.50	-0.266D 12	-0.600D 12	0.443D 13
64.50	65.00	65.50	-0.276D 12	-0.516D 12	0.516D 13
65.50	66.00	66.50	-0.284D 12	-0.420D 12	0.586D 13
66.50	67.00	67.50	-0.291D 12	-0.312D 12	0.651D 13
67.50	68.00	68.50	-0.295D 12	-0.193D 12	0.710D 13
68.50	69.00	69.25	-0.297D 12	-0.648D 11	0.761D 13
69.25	69.50	69.75	-0.298D 12	0.252D 10	0.783D 13
69.75	70.00	70.50	-0.297D 12	0.717D 11	0.802D 13
70.50	71.00	72.00	-0.295D 12	0.215D 12	0.834D 13
72.00	74.00	76.00	-0.272D 12	0.662D 12	0.857D 13
76.00	77.00	78.00	-0.226D 12	0.109D 13	0.764D 13
78.00	79.00	80.00	-0.183D 12	0.134D 13	0.638D 13
80.00	81.00	82.00	-0.133D 12	0.153D 13	0.470D 13
82.00	83.00	84.00	-0.769D 11	0.166D 13	0.270D 13
84.00	85.00	86.00	-0.177D 11	0.172D 13	0.521D 12
86.00	87.00	88.00	0.422D 11	0.170D 13	-0.169D 13
88.00	89.00	90.00	0.100D 12	0.160D 13	-0.377D 13
90.00	91.00	92.00	0.153D 12	0.144D 13	-0.558D 13
92.00	93.00	94.00	0.200D 12	0.122D 13	-0.700D 13
94.00	96.00	98.00	0.253D 12	0.814D 12	-0.824D 13
98.00	99.00	100.00	0.284D 12	0.375D 12	-0.834D 13
100.00	100.50	101.00	0.291D 12	0.161D 12	-0.798D 13
101.00	101.50	101.62	0.293D 12	0.249D 11	-0.762D 13
101.62	101.75	102.00	0.293D 12	-0.816D 10	-0.751D 13
102.00	102.25	102.50	0.293D 12	-0.728D 11	-0.729D 13
102.50	102.75	103.00	0.292D 12	-0.135D 12	-0.704D 13
103.00	103.50	104.00	0.289D 12	-0.225D 12	-0.663D 13
104.00	104.50	105.00	0.285D 12	-0.335D 12	-0.603D 13
105.00	105.50	106.00	0.278D 12	-0.435D 12	-0.538D 13
106.00	106.50	107.00	0.269D 12	-0.523D 12	-0.470D 13
107.00	107.50	108.00	0.260D 12	-0.599D 12	-0.399D 13
108.00	109.00	110.00	0.243D 12	-0.689D 12	-0.292D 13
110.00	111.00	111.00	0.217D 12	-0.767D 12	-0.155D 13

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=13 M=13 P= 5

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.50	31.00	0.909D 10	0.147D 12	0.201D 13
31.00	31.50	32.00	0.120D 11	0.185D 12	0.241D 13
32.00	32.50	33.00	0.156D 11	0.231D 12	0.286D 13
33.00	33.50	34.00	0.201D 11	0.285D 12	0.336D 13
34.00	34.50	35.00	0.256D 11	0.349D 12	0.391D 13
35.00	35.50	36.00	0.323D 11	0.422D 12	0.450D 13
36.00	36.50	37.00	0.404D 11	0.506D 12	0.513D 13
37.00	37.50	38.00	0.501D 11	0.602D 12	0.579D 13
38.00	39.00	40.00	0.679D 11	0.767D 12	0.682D 13
40.00	41.00	42.00	0.991D 11	0.103D 13	0.821D 13
42.00	43.00	44.00	0.140D 12	0.134D 13	0.952D 13
44.00	45.00	47.00	0.193D 12	0.169D 13	0.106D 14
47.00	51.00	53.00	0.432D 12	0.288D 13	0.112D 14
53.00	54.00	56.00	0.597D 12	0.343D 13	0.940D 13
56.00	57.00	58.00	0.788D 12	0.383D 13	0.592D 13
58.00	59.00	60.00	0.925D 12	0.399D 13	0.277D 13
60.00	61.00	62.00	0.106D 13	0.402D 13	-0.889D 12
62.00	63.00	64.00	0.120D 13	0.392D 13	-0.488D 13
64.00	65.00	66.00	0.134D 13	0.368D 13	-0.897D 13
66.00	67.00	68.00	0.146D 13	0.330D 13	-0.129D 14
68.00	69.00	70.00	0.157D 13	0.278D 13	-0.165D 14
70.00	71.00	72.00	0.165D 13	0.215D 13	-0.194D 14
72.00	73.00	74.00	0.171D 13	0.144D 13	-0.215D 14
74.00	77.00	78.00	0.176D 13	-0.137D 12	-0.228D 14
78.00	79.00	80.00	0.174D 13	-0.922D 12	-0.220D 14
80.00	81.00	82.00	0.170D 13	-0.166D 13	-0.202D 14
82.00	83.00	84.00	0.163D 13	-0.232D 13	-0.176D 14
84.00	85.00	86.00	0.154D 13	-0.288D 13	-0.143D 14
86.00	87.00	88.00	0.143D 13	-0.332D 13	-0.107D 14
88.00	89.00	90.00	0.131D 13	-0.362D 13	-0.687D 13
90.00	91.00	92.00	0.118D 13	-0.380D 13	-0.311D 13
92.00	93.00	94.00	0.104D 13	-0.384D 13	0.406D 12
94.00	95.00	96.00	0.909D 12	-0.377D 13	0.350D 13
96.00	97.00	98.00	0.780D 12	-0.360D 13	0.606D 13
98.00	100.00	102.00	0.601D 12	-0.321D 13	0.876D 13
102.00	107.00	109.00	0.282D 12	-0.200D 13	0.997D 13
109.00	111.00	111.00	0.165D 12	-0.135D 13	0.844D 13

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=13 M=13 P= 6

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.25	30.50	0.825D 09	0.167D 11	0.301D 12
30.50	30.75	31.00	0.983D 09	0.196D 11	0.343D 12
31.00	31.25	31.50	0.117D 10	0.228D 11	0.391D 12
31.50	31.75	32.00	0.138D 10	0.264D 11	0.444D 12
32.00	32.50	33.00	0.177D 10	0.328D 11	0.533D 12
33.00	33.50	34.00	0.243D 10	0.433D 11	0.675D 12
34.00	34.50	35.00	0.329D 10	0.565D 11	0.844D 12
35.00	35.50	36.00	0.442D 10	0.729D 11	0.104D 13
36.00	36.50	37.00	0.586D 10	0.931D 11	0.128D 13
37.00	37.50	38.00	0.769D 10	0.118D 12	0.155D 13
38.00	38.50	39.00	0.100D 11	0.147D 12	0.186D 13
39.00	39.50	40.00	0.129D 11	0.183D 12	0.221D 13
40.00	40.50	41.00	0.164D 11	0.225D 12	0.260D 13
41.00	41.50	42.00	0.208D 11	0.274D 12	0.303D 13
42.00	42.50	43.00	0.260D 11	0.331D 12	0.350D 13
43.00	43.50	44.00	0.323D 11	0.396D 12	0.401D 13
44.00	44.50	45.00	0.399D 11	0.471D 12	0.456D 13
45.00	45.50	46.00	0.488D 11	0.555D 12	0.514D 13
46.00	47.00	48.00	0.652D 11	0.702D 12	0.604D 13
48.00	49.00	50.00	0.937D 11	0.934D 12	0.729D 13
50.00	51.00	52.00	0.131D 12	0.121D 13	0.850D 13
52.00	53.00	55.00	0.179D 12	0.153D 13	0.957D 13
55.00	59.00	62.00	0.395D 12	0.262D 13	0.107D 14
62.00	64.00	65.00	0.662D 12	0.346D 13	0.780D 13
65.00	66.00	67.00	0.787D 12	0.369D 13	0.546D 13
67.00	68.00	69.00	0.919D 12	0.384D 13	0.251D 13
69.00	70.00	71.00	0.105D 13	0.386D 13	-0.932D 12
71.00	72.00	73.00	0.119D 13	0.377D 13	-0.471D 13
73.00	74.00	75.00	0.131D 13	0.353D 13	-0.861D 13
75.00	76.00	77.00	0.143D 13	0.317D 13	-0.124D 14
77.00	78.00	79.00	0.153D 13	0.267D 13	-0.159D 14
79.00	80.00	81.00	0.162D 13	0.207D 13	-0.188D 14
81.00	82.00	83.00	0.168D 13	0.137D 13	-0.209D 14
83.00	87.00	88.00	0.171D 13	-0.549D 12	-0.221D 14
88.00	89.00	90.00	0.168D 13	-0.130D 13	-0.208D 14
90.00	91.00	92.00	0.162D 13	-0.199D 13	-0.187D 14
92.00	93.00	94.00	0.154D 13	-0.260D 13	-0.158D 14
94.00	95.00	96.00	0.144D 13	-0.309D 13	-0.124D 14
96.00	97.00	98.00	0.133D 13	-0.346D 13	-0.869D 13
98.00	99.00	100.00	0.120D 13	-0.370D 13	-0.488D 13
100.00	101.00	102.00	0.107D 13	-0.380D 13	-0.120D 13
102.00	103.00	104.00	0.940D 12	-0.379D 13	0.215D 13
104.00	105.00	106.00	0.810D 12	-0.366D 13	0.503D 13
106.00	108.00	110.00	0.627D 12	-0.331D 13	0.822D 13
110.00	111.00	111.00	0.466D 12	-0.282D 13	0.997D 13

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=14 M=13 P= 6

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.50	31.00	-0.561D 11	-0.977D 12	-0.145D 14
31.00	31.50	32.00	-0.755D 11	-0.126D 13	-0.177D 14
32.00	32.50	33.00	-0.100D 12	-0.160D 13	-0.213D 14
33.00	33.50	34.00	-0.132D 12	-0.200D 13	-0.254D 14
34.00	34.50	35.00	-0.171D 12	-0.248D 13	-0.298D 14
35.00	35.50	36.00	-0.219D 12	-0.305D 13	-0.346D 14
36.00	36.50	37.00	-0.278D 12	-0.369D 13	-0.396D 14
37.00	37.50	38.00	-0.348D 12	-0.443D 13	-0.449D 14
38.00	39.00	40.00	-0.481D 12	-0.571D 13	-0.529D 14
40.00	41.00	42.00	-0.714D 12	-0.774D 13	-0.631D 14
42.00	43.00	45.00	-0.102D 13	-0.101D 14	-0.713D 14
45.00	47.00	49.00	-0.191D 13	-0.153D 14	-0.758D 14
49.00	50.00	51.00	-0.281D 13	-0.190D 14	-0.624D 14
51.00	52.00	53.00	-0.351D 13	-0.209D 14	-0.435D 14
53.00	54.00	55.00	-0.426D 13	-0.220D 14	-0.165D 14
55.00	56.00	57.00	-0.504D 13	-0.220D 14	0.178D 14
57.00	58.00	59.00	-0.578D 13	-0.207D 14	0.578D 14
59.00	60.00	60.50	-0.646D 13	-0.179D 14	0.101D 15
60.50	61.00	61.50	-0.676D 13	-0.160D 14	0.122D 15
61.50	62.00	62.50	-0.702D 13	-0.136D 14	0.143D 15
62.50	63.00	63.50	-0.723D 13	-0.110D 14	0.163D 15
63.50	64.00	64.50	-0.740D 13	-0.794D 13	0.182D 15
64.50	65.00	65.25	-0.751D 13	-0.462D 13	0.198D 15
65.25	65.50	65.75	-0.754D 13	-0.286D 13	0.206D 15
65.75	66.00	66.12	-0.756D 13	-0.103D 13	0.212D 15
66.12	66.25	66.50	-0.756D 13	-0.995D 11	0.215D 15
66.50	66.75	67.00	-0.755D 13	0.181D 13	0.221D 15
67.00	67.50	68.00	-0.751D 13	0.475D 13	0.228D 15
68.00	70.00	72.00	-0.708D 13	0.150D 14	0.237D 15
72.00	73.00	74.00	-0.598D 13	0.270D 14	0.216D 15
74.00	75.00	76.00	-0.491D 13	0.340D 14	0.182D 15
76.00	77.00	78.00	-0.362D 13	0.396D 14	0.136D 15
78.00	79.00	80.00	-0.217D 13	0.433D 14	0.800D 14
80.00	81.00	82.00	-0.620D 12	0.451D 14	0.183D 14
82.00	83.00	84.00	0.952D 12	0.446D 14	-0.443D 14
84.00	85.00	86.00	0.247D 13	0.420D 14	-0.103D 15
86.00	87.00	88.00	0.386D 13	0.375D 14	-0.154D 15
88.00	89.00	90.00	0.507D 13	0.314D 14	-0.192D 15
90.00	92.00	94.00	0.643D 13	0.204D 14	-0.224D 15
94.00	95.00	95.50	0.719D 13	0.853D 13	-0.223D 15
95.50	96.00	96.50	0.731D 13	0.470D 13	-0.216D 15
96.50	97.00	97.12	0.736D 13	0.102D 13	-0.206D 15
97.12	97.25	97.50	0.736D 13	0.125D 12	-0.203D 15
97.50	97.75	98.00	0.735D 13	-0.161D 13	-0.196D 15
98.00	98.25	98.50	0.733D 13	-0.330D 13	-0.189D 15
98.50	99.00	99.50	0.727D 13	-0.570D 13	-0.178D 15
99.50	100.00	100.50	0.715D 13	-0.866D 13	-0.161D 15
100.50	101.00	101.50	0.697D 13	-0.113D 14	-0.143D 15
101.50	102.00	102.50	0.675D 13	-0.136D 14	-0.124D 15
102.50	103.00	104.00	0.650D 13	-0.156D 14	-0.104D 15
104.00	105.00	106.00	0.590D 13	-0.186D 14	-0.648D 14
106.00	107.00	108.00	0.522D 13	-0.202D 14	-0.282D 14
108.00	109.00	110.00	0.450D 13	-0.206D 14	0.393D 13
110.00	111.00	111.00	0.379D 13	-0.200D 14	0.298D 14

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=14 M=13 P= 7

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.25	30.50	-0.520D 10	-0.113D 12	-0.218D 13
30.50	30.75	31.00	-0.627D 10	-0.133D 12	-0.251D 13
31.00	31.25	31.50	-0.753D 10	-0.157D 12	-0.289D 13
31.50	31.75	32.00	-0.902D 10	-0.184D 12	-0.331D 13
32.00	32.25	32.50	-0.108D 11	-0.215D 12	-0.378D 13
32.50	32.75	33.00	-0.128D 11	-0.250D 12	-0.431D 13
33.00	33.25	33.50	-0.151D 11	-0.290D 12	-0.489D 13
33.50	34.00	34.50	-0.194D 11	-0.360D 12	-0.587D 13
34.50	35.00	35.50	-0.266D 11	-0.476D 12	-0.741D 13
35.50	36.00	36.50	-0.362D 11	-0.621D 12	-0.924D 13
36.50	37.00	37.50	-0.485D 11	-0.800D 12	-0.114D 14
37.50	38.00	38.50	-0.643D 11	-0.102D 13	-0.139D 14
38.50	39.00	39.50	-0.844D 11	-0.129D 13	-0.167D 14
39.50	40.00	40.50	-0.110D 12	-0.161D 13	-0.199D 14
40.50	41.00	41.50	-0.141D 12	-0.198D 13	-0.234D 14
41.50	42.00	42.50	-0.179D 12	-0.242D 13	-0.273D 14
42.50	43.00	43.50	-0.226D 12	-0.294D 13	-0.315D 14
43.50	44.00	45.00	-0.282D 12	-0.353D 13	-0.359D 14
45.00	46.00	47.00	-0.429D 12	-0.494D 13	-0.452D 14
47.00	48.00	49.00	-0.631D 12	-0.668D 13	-0.545D 14
49.00	50.00	51.00	-0.899D 12	-0.874D 13	-0.628D 14
51.00	55.00	57.00	-0.192D 13	-0.147D 14	-0.700D 14
57.00	58.00	59.00	-0.278D 13	-0.181D 14	-0.581D 14
59.00	60.00	61.00	-0.345D 13	-0.199D 14	-0.414D 14
61.00	62.00	63.00	-0.416D 13	-0.209D 14	-0.171D 14
63.00	64.00	65.00	-0.490D 13	-0.210D 14	0.142D 14
65.00	66.00	67.00	-0.561D 13	-0.199D 14	0.510D 14
67.00	68.00	68.50	-0.627D 13	-0.174D 14	0.911D 14
68.50	69.00	69.50	-0.656D 13	-0.156D 14	0.112D 15
69.50	70.00	70.50	-0.681D 13	-0.135D 14	0.132D 15
70.50	71.00	71.50	-0.703D 13	-0.110D 14	0.151D 15
71.50	72.00	72.50	-0.720D 13	-0.825D 13	0.169D 15
72.50	73.00	73.50	-0.731D 13	-0.515D 13	0.186D 15
73.50	74.00	74.25	-0.737D 13	-0.177D 13	0.200D 15
74.25	74.50	74.75	-0.738D 13	0.490D 10	0.207D 15
74.75	75.00	75.50	-0.737D 13	0.183D 13	0.212D 15
75.50	76.00	77.00	-0.731D 13	0.562D 13	0.221D 15
77.00	79.00	81.00	-0.670D 13	0.175D 14	0.229D 15
81.00	82.00	83.00	-0.548D 13	0.290D 14	0.202D 15
83.00	84.00	85.00	-0.435D 13	0.355D 14	0.167D 15
85.00	86.00	87.00	-0.302D 13	0.405D 14	0.119D 15
87.00	88.00	89.00	-0.155D 13	0.436D 14	0.616D 14
89.00	90.00	91.00	0.160D 05	0.447D 14	-0.641D 06
91.00	92.00	93.00	0.155D 13	0.436D 14	-0.616D 14
93.00	94.00	95.00	0.302D 13	0.405D 14	-0.119D 15
95.00	96.00	97.00	0.435D 13	0.355D 14	-0.167D 15
97.00	98.00	99.00	0.548D 13	0.290D 14	-0.202D 15
99.00	103.00	104.00	0.718D 13	0.955D 13	-0.227D 15
104.00	104.50	104.75	0.735D 13	0.371D 13	-0.217D 15
104.75	105.00	105.25	0.737D 13	0.183D 13	-0.212D 15
105.25	105.50	105.75	0.738D 13	0.490D 10	-0.207D 15
105.75	106.00	106.50	0.737D 13	-0.177D 13	-0.200D 15
106.50	107.00	107.50	0.731D 13	-0.515D 13	-0.186D 15
107.50	108.00	108.50	0.720D 13	-0.825D 13	-0.169D 15
108.50	109.00	109.50	0.703D 13	-0.110D 14	-0.151D 15
109.50	110.00	110.00	0.681D 13	-0.135D 14	-0.132D 15

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=14 M=14 P= 6

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.25	30.50	0.363D 11	0.728D 12	0.128D 14
30.50	30.75	31.00	0.432D 11	0.847D 12	0.146D 14
31.00	31.25	31.50	0.511D 11	0.983D 12	0.166D 14
31.50	32.00	32.50	0.655D 11	0.122D 13	0.199D 14
32.50	33.00	33.50	0.901D 11	0.161D 13	0.251D 14
33.50	34.00	34.50	0.122D 12	0.210D 13	0.313D 14
34.50	35.00	35.50	0.164D 12	0.271D 13	0.386D 14
35.50	36.00	36.50	0.218D 12	0.345D 13	0.470D 14
36.50	37.00	37.50	0.286D 12	0.436D 13	0.567D 14
37.50	38.00	38.50	0.371D 12	0.544D 13	0.677D 14
38.50	39.00	39.50	0.477D 12	0.673D 13	0.800D 14
39.50	40.00	40.50	0.607D 12	0.824D 13	0.935D 14
40.50	41.00	41.50	0.766D 12	0.100D 14	0.108D 15
41.50	42.00	42.50	0.958D 12	0.120D 14	0.124D 15
42.50	43.00	44.00	0.119D 13	0.143D 14	0.141D 15
44.00	45.00	46.00	0.178D 13	0.199D 14	0.177D 15
46.00	47.00	48.00	0.259D 13	0.268D 14	0.215D 15
48.00	49.00	50.00	0.366D 13	0.349D 14	0.250D 15
50.00	51.00	53.00	0.504D 13	0.442D 14	0.281D 15
53.00	57.00	59.00	0.113D 14	0.758D 14	0.301D 15
59.00	60.00	62.00	0.157D 14	0.905D 14	0.251D 15
62.00	63.00	64.00	0.207D 14	0.101D 15	0.153D 15
64.00	65.00	66.00	0.243D 14	0.105D 15	0.647D 14
66.00	67.00	68.00	0.280D 14	0.106D 15	-0.389D 14
68.00	69.00	70.00	0.316D 14	0.102D 15	-0.152D 15
70.00	71.00	72.00	0.351D 14	0.950D 14	-0.267D 15
72.00	73.00	74.00	0.382D 14	0.837D 14	-0.378D 15
74.00	75.00	76.00	0.409D 14	0.687D 14	-0.475D 15
76.00	77.00	78.00	0.430D 14	0.507D 14	-0.554D 15
78.00	79.00	80.00	0.444D 14	0.304D 14	-0.607D 15
80.00	82.00	83.00	0.452D 14	-0.235D 13	-0.632D 15
83.00	83.50	84.00	0.449D 14	-0.187D 14	-0.618D 15
84.00	85.00	86.00	0.442D 14	-0.346D 14	-0.588D 15
86.00	87.00	88.00	0.426D 14	-0.541D 14	-0.525D 15
88.00	89.00	90.00	0.404D 14	-0.710D 14	-0.440D 15
90.00	91.00	92.00	0.377D 14	-0.846D 14	-0.339D 15
92.00	93.00	94.00	0.346D 14	-0.946D 14	-0.230D 15
94.00	95.00	96.00	0.311D 14	-0.101D 15	-0.119D 15
96.00	97.00	98.00	0.276D 14	-0.103D 15	-0.142D 14
98.00	99.00	100.00	0.240D 14	-0.102D 15	0.798D 14
100.00	101.00	102.00	0.205D 14	-0.976D 14	0.158D 15
102.00	104.00	106.00	0.157D 14	-0.869D 14	0.242D 15
106.00	111.00	111.00	0.706D 13	-0.531D 14	0.280D 15

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=14 M=14 P= 7

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.25	30.50	0.303D 10	0.728D 11	0.158D 13
30.50	30.75	31.00	0.373D 10	0.878D 11	0.187D 13
31.00	31.25	31.50	0.457D 10	0.105D 12	0.220D 13
31.50	31.75	32.00	0.558D 10	0.126D 12	0.257D 13
32.00	32.25	32.50	0.679D 10	0.151D 12	0.301D 13
32.50	32.75	33.00	0.822D 10	0.179D 12	0.350D 13
33.00	33.25	33.50	0.992D 10	0.212D 12	0.406D 13
33.50	33.75	34.00	0.119D 11	0.250D 12	0.470D 13
34.00	34.25	34.50	0.143D 11	0.294D 12	0.542D 13
34.50	34.75	35.00	0.171D 11	0.345D 12	0.622D 13
35.00	35.25	35.50	0.203D 11	0.403D 12	0.713D 13
35.50	35.75	36.00	0.241D 11	0.470D 12	0.814D 13
36.00	36.25	36.50	0.286D 11	0.545D 12	0.927D 13
36.50	36.75	37.00	0.337D 11	0.632D 12	0.105D 14
37.00	37.50	38.00	0.429D 11	0.783D 12	0.127D 14
38.00	38.50	39.00	0.587D 11	0.103D 13	0.161D 14
39.00	39.50	40.00	0.794D 11	0.135D 13	0.201D 14
40.00	40.50	41.00	0.106D 12	0.174D 13	0.250D 14
41.00	41.50	42.00	0.141D 12	0.223D 13	0.307D 14
42.00	42.50	43.00	0.185D 12	0.282D 13	0.374D 14
43.00	43.50	44.00	0.240D 12	0.354D 13	0.451D 14
44.00	44.50	45.00	0.309D 12	0.440D 13	0.539D 14
45.00	45.50	46.00	0.394D 12	0.542D 13	0.638D 14
46.00	46.50	47.00	0.499D 12	0.653D 13	0.748D 14
47.00	47.50	48.00	0.627D 12	0.804D 13	0.870D 14
48.00	48.50	49.00	0.781D 12	0.968D 13	0.100D 15
49.00	49.50	50.00	0.966D 12	0.116D 14	0.115D 15
50.00	50.50	51.00	0.119D 13	0.137D 14	0.130D 15
51.00	52.00	53.00	0.159D 13	0.174D 14	0.155D 15
53.00	54.00	55.00	0.230D 13	0.234D 14	0.189D 15
55.00	56.00	57.00	0.324D 13	0.306D 14	0.223D 15
57.00	58.00	60.00	0.445D 13	0.389D 14	0.254D 15
60.00	65.00	67.00	0.113D 14	0.736D 14	0.288D 15
67.00	69.00	70.00	0.171D 14	0.918D 14	0.219D 15
70.00	71.00	72.00	0.204D 14	0.984D 14	0.155D 15
72.00	73.00	74.00	0.239D 14	0.102D 15	0.720D 14
74.00	75.00	76.00	0.275D 14	0.103D 15	-0.257D 14
76.00	77.00	78.00	0.311D 14	0.100D 15	-0.134D 15
78.00	79.00	80.00	0.345D 14	0.939D 14	-0.246D 15
80.00	81.00	82.00	0.376D 14	0.834D 14	-0.355D 15
82.00	83.00	84.00	0.403D 14	0.692D 14	-0.453D 15
84.00	85.00	86.00	0.424D 14	0.519D 14	-0.534D 15
86.00	87.00	88.00	0.439D 14	0.322D 14	-0.592D 15
88.00	91.00	92.00	0.446D 14	-0.109D 14	-0.622D 15
92.00	93.00	94.00	0.439D 14	-0.322D 14	-0.592D 15
94.00	95.00	96.00	0.424D 14	-0.519D 14	-0.534D 15
96.00	97.00	98.00	0.403D 14	-0.692D 14	-0.453D 15
98.00	99.00	100.00	0.376D 14	-0.834D 14	-0.355D 15
100.00	101.00	102.00	0.345D 14	-0.939D 14	-0.246D 15
102.00	103.00	104.00	0.311D 14	-0.100D 15	-0.134D 15
104.00	105.00	106.00	0.275D 14	-0.103D 15	-0.257D 14
106.00	107.00	108.00	0.239D 14	-0.102D 15	0.720D 14
108.00	109.00	110.00	0.204D 14	-0.984D 14	0.155D 15
110.00	111.00	111.00	0.171D 14	-0.918D 14	0.219D 15

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=15 M=14 P= 6

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.50	31.00	-0.232D 13	-0.397D 14	-0.571D 15
31.00	31.50	32.00	-0.311D 13	-0.507D 14	-0.690D 15
32.00	32.50	33.00	-0.411D 13	-0.639D 14	-0.822D 15
33.00	33.50	34.00	-0.535D 13	-0.795D 14	-0.967D 15
34.00	34.50	35.00	-0.689D 13	-0.977D 14	-0.112D 16
35.00	35.50	36.00	-0.878D 13	-0.119D 15	-0.128D 16
36.00	36.50	37.00	-0.111D 14	-0.142D 15	-0.145D 16
37.00	38.00	39.00	-0.153D 14	-0.184D 15	-0.170D 16
39.00	40.00	41.00	-0.228D 14	-0.248D 15	-0.200D 16
41.00	43.00	47.00	-0.387D 14	-0.361D 15	-0.227D 16
47.00	48.00	49.00	-0.787D 14	-0.550D 15	-0.182D 16
49.00	50.00	51.00	-0.989D 14	-0.604D 15	-0.121D 16
51.00	52.00	53.00	-0.121D 15	-0.631D 15	-0.333D 15
53.00	54.00	55.00	-0.143D 15	-0.624D 15	0.771D 15
55.00	56.00	56.50	-0.164D 15	-0.576D 15	0.204D 16
56.50	57.00	57.50	-0.173D 15	-0.534D 15	0.270D 16
57.50	58.00	58.50	-0.182D 15	-0.481D 15	0.337D 16
58.50	59.00	59.50	-0.190D 15	-0.417D 15	0.403D 16
59.50	60.00	60.50	-0.197D 15	-0.341D 15	0.466D 16
60.50	61.00	61.50	-0.202D 15	-0.254D 15	0.524D 16
61.50	62.00	62.50	-0.206D 15	-0.158D 15	0.576D 16
62.50	63.00	63.25	-0.207D 15	-0.536D 14	0.621D 16
63.25	63.50	63.75	-0.208D 15	0.147D 13	0.640D 16
63.75	64.00	64.50	-0.207D 15	0.581D 14	0.657D 16
64.50	65.00	66.00	-0.205D 15	0.175D 15	0.683D 16
66.00	68.00	69.00	-0.187D 15	0.539D 15	0.690D 16
69.00	70.00	71.00	-0.164D 15	0.772D 15	0.633D 16
71.00	72.00	73.00	-0.133D 15	0.976D 15	0.528D 16
73.00	74.00	75.00	-0.961D 14	0.114D 16	0.383D 16
75.00	76.00	77.00	-0.545D 14	0.124D 16	0.208D 16
77.00	78.00	79.00	-0.103D 14	0.128D 16	0.183D 15
79.00	80.00	81.00	0.340D 14	0.125D 16	-0.171D 16
81.00	82.00	83.00	0.764D 14	0.116D 16	-0.344D 16
83.00	84.00	85.00	0.115D 15	0.102D 16	-0.487D 16
85.00	86.00	87.00	0.147D 15	0.826D 15	-0.591D 16
87.00	91.00	91.50	0.195D 15	0.263D 15	-0.651D 16
91.50	92.00	92.50	0.198D 15	0.151D 15	-0.630D 16
92.50	93.00	93.12	0.200D 15	0.439D 14	-0.600D 16
93.12	93.25	93.37	0.200D 15	0.179D 14	-0.592D 16
93.37	93.44	93.50	0.200D 15	-0.131D 13	-0.585D 16
93.50	93.62	94.00	0.200D 15	-0.203D 14	-0.577D 16
94.00	94.25	94.50	0.200D 15	-0.819D 14	-0.552D 16
94.50	95.00	95.50	0.198D 15	-0.152D 15	-0.517D 16
95.50	96.00	96.50	0.195D 15	-0.238D 15	-0.467D 16
96.50	97.00	97.50	0.190D 15	-0.315D 15	-0.412D 16
97.50	98.00	98.50	0.184D 15	-0.382D 15	-0.355D 16
98.50	99.00	99.50	0.177D 15	-0.438D 15	-0.296D 16
99.50	100.00	101.00	0.168D 15	-0.485D 15	-0.237D 16
101.00	102.00	103.00	0.150D 15	-0.548D 15	-0.124D 16
103.00	104.00	105.00	0.131D 15	-0.573D 15	-0.231D 15
105.00	106.00	107.00	0.111D 15	-0.566D 15	0.603D 15
107.00	108.00	109.00	0.914D 14	-0.533D 15	0.123D 16
109.00	111.00	111.00	0.655D 14	-0.453D 15	0.177D 16

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=15 M=14 P= 7

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.25	30.50	-0.243D 12	-0.520D 13	-0.983D 14
30.50	30.75	31.00	-0.292D 12	-0.612D 13	-0.113D 15
31.00	31.25	31.50	-0.350D 12	-0.718D 13	-0.129D 15
31.50	31.75	32.00	-0.418D 12	-0.838D 13	-0.148D 15
32.00	32.25	32.50	-0.497D 12	-0.976D 13	-0.168D 15
32.50	33.00	33.50	-0.640D 12	-0.122D 14	-0.202D 15
33.50	34.00	34.50	-0.886D 12	-0.162D 14	-0.256D 15
34.50	35.00	35.50	-0.121D 13	-0.212D 14	-0.320D 15
35.50	36.00	36.50	-0.163D 13	-0.274D 14	-0.394D 15
36.50	37.00	37.50	-0.217D 13	-0.350D 14	-0.480D 15
37.50	38.00	38.50	-0.286D 13	-0.442D 14	-0.578D 15
38.50	39.00	39.50	-0.373D 13	-0.552D 14	-0.687D 15
39.50	40.00	40.50	-0.480D 13	-0.682D 14	-0.806D 15
40.50	41.00	41.50	-0.612D 13	-0.834D 14	-0.936D 15
41.50	42.00	42.50	-0.773D 13	-0.101D 15	-0.107D 16
42.50	43.00	44.00	-0.966D 13	-0.121D 15	-0.122D 16
44.00	45.00	46.00	-0.147D 14	-0.169D 15	-0.151D 16
46.00	47.00	48.00	-0.215D 14	-0.226D 15	-0.178D 16
48.00	50.00	55.00	-0.360D 14	-0.328D 15	-0.207D 16
55.00	56.00	57.00	-0.816D 14	-0.535D 15	-0.158D 16
57.00	58.00	59.00	-0.101D 15	-0.589D 15	-0.981D 15
59.00	60.00	61.00	-0.122D 15	-0.600D 15	-0.141D 15
61.00	62.00	63.00	-0.143D 15	-0.588D 15	0.907D 15
63.00	64.00	64.50	-0.162D 15	-0.535D 15	0.210D 16
64.50	65.00	65.50	-0.171D 15	-0.493D 15	0.273D 16
65.50	66.00	66.50	-0.180D 15	-0.440D 15	0.335D 16
66.50	67.00	67.50	-0.187D 15	-0.376D 15	0.397D 16
67.50	68.00	68.50	-0.193D 15	-0.302D 15	0.456D 16
68.50	69.00	69.50	-0.197D 15	-0.217D 15	0.511D 16
69.50	70.00	70.25	-0.200D 15	-0.124D 15	0.560D 16
70.25	70.50	70.75	-0.201D 15	-0.740D 14	0.582D 16
70.75	71.00	71.12	-0.201D 15	-0.223D 14	0.602D 16
71.12	71.25	71.50	-0.201D 15	0.412D 13	0.611D 16
71.50	71.75	72.00	-0.201D 15	0.582D 14	0.628D 16
72.00	72.50	73.00	-0.200D 15	0.142D 15	0.649D 16
73.00	75.00	77.00	-0.187D 15	0.433D 15	0.675D 16
77.00	78.00	79.00	-0.156D 15	0.774D 15	0.609D 16
79.00	80.00	81.00	-0.125D 15	0.970D 15	0.507D 16
81.00	82.00	83.00	-0.884D 14	0.112D 16	0.365D 16
83.00	84.00	85.00	-0.473D 14	0.122D 16	0.194D 16
85.00	86.00	87.00	-0.389D 13	0.126D 16	0.834D 14
87.00	88.00	89.00	0.397D 14	0.123D 16	-0.178D 16
89.00	90.00	91.00	0.810D 14	0.113D 16	-0.348D 16
91.00	92.00	93.00	0.118D 15	0.987D 15	-0.490D 16
93.00	94.00	95.00	0.149D 15	0.797D 15	-0.593D 16
95.00	99.00	99.50	0.195D 15	0.233D 15	-0.650D 16
99.50	100.00	100.50	0.198D 15	0.121D 15	-0.628D 16
100.50	100.75	100.87	0.199D 15	0.407D 14	-0.606D 16
100.87	101.00	101.06	0.199D 15	0.144D 14	-0.597D 16
101.06	101.12	101.25	0.199D 15	0.145D 13	-0.593D 16
101.25	101.37	101.50	0.199D 15	-0.242D 14	-0.583D 16
101.50	101.75	102.00	0.199D 15	-0.619D 14	-0.568D 16
102.00	102.25	102.50	0.198D 15	-0.111D 15	-0.547D 16
102.50	103.00	103.50	0.196D 15	-0.180D 15	-0.511D 16
103.50	104.00	104.50	0.192D 15	-0.265D 15	-0.459D 16
104.50	105.00	105.50	0.187D 15	-0.340D 15	-0.403D 16
105.50	106.00	106.50	0.180D 15	-0.405D 15	-0.344D 16
106.50	107.00	107.50	0.173D 15	-0.460D 15	-0.284D 16
107.50	108.00	109.00	0.164D 15	-0.504D 15	-0.224D 16
109.00	110.00	110.00	0.146D 15	-0.562D 15	-0.109D 16

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=15 M=15 P= 6

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.25	30.50	0.164D 13	0.323D 14	0.559D 15
30.50	30.75	31.00	0.194D 13	0.375D 14	0.634D 15
31.00	31.50	32.00	0.249D 13	0.466D 14	0.760D 15
32.00	32.50	33.00	0.343D 13	0.616D 14	0.958D 15
33.00	33.50	34.00	0.466D 13	0.803D 14	0.119D 16
34.00	34.50	35.00	0.626D 13	0.103D 15	0.147D 16
35.00	35.50	36.00	0.830D 13	0.132D 15	0.178D 16
36.00	36.50	37.00	0.109D 14	0.166D 15	0.214D 16
37.00	37.50	38.00	0.141D 14	0.207D 15	0.254D 16
38.00	38.50	39.00	0.181D 14	0.255D 15	0.298D 16
39.00	39.50	40.00	0.231D 14	0.311D 15	0.347D 16
40.00	40.50	41.00	0.290D 14	0.376D 15	0.399D 16
41.00	41.50	42.00	0.362D 14	0.450D 15	0.454D 16
42.00	42.50	43.00	0.448D 14	0.535D 15	0.512D 16
43.00	44.00	45.00	0.607D 14	0.680D 15	0.602D 16
45.00	46.00	47.00	0.883D 14	0.911D 15	0.719D 16
47.00	48.00	49.00	0.125D 15	0.118D 16	0.825D 16
49.00	51.00	57.00	0.198D 15	0.164D 16	0.932D 16
57.00	58.00	59.00	0.469D 15	0.273D 16	0.722D 16
59.00	60.00	61.00	0.568D 15	0.295D 16	0.511D 16
61.00	62.00	63.00	0.674D 15	0.308D 16	0.237D 16
63.00	64.00	65.00	0.782D 15	0.311D 16	-0.871D 15
65.00	66.00	67.00	0.889D 15	0.302D 16	-0.444D 16
67.00	68.00	69.00	0.991D 25	0.280D 16	-0.809D 16
69.00	70.00	71.00	0.108D 16	0.246D 16	-0.116D 17
71.00	72.00	73.00	0.116D 16	0.200D 16	-0.146D 17
73.00	74.00	75.00	0.122D 16	0.144D 16	-0.170D 17
75.00	76.00	77.00	0.126D 16	0.817D 15	-0.186D 17
77.00	79.00	80.00	0.128D 16	-0.179D 15	-0.191D 17
80.00	80.50	81.00	0.127D 16	-0.673D 15	-0.185D 17
81.00	82.00	83.00	0.124D 16	-0.115D 16	-0.174D 17
83.00	84.00	85.00	0.119D 16	-0.172D 16	-0.152D 17
85.00	86.00	87.00	0.112D 16	-0.220D 16	-0.124D 17
87.00	88.00	89.00	0.104D 16	-0.258D 16	-0.913D 16
89.00	90.00	91.00	0.946D 15	-0.284D 16	-0.567D 16
91.00	92.00	93.00	0.844D 15	-0.297D 16	-0.227D 16
93.00	94.00	95.00	0.739D 15	-0.300D 16	0.864D 15
95.00	96.00	97.00	0.636D 15	-0.292D 16	0.357D 16
97.00	98.00	99.00	0.536D 15	-0.276D 16	0.572D 16
99.00	101.00	103.00	0.401D 15	-0.239D 16	0.782D 16
103.00	107.00	109.00	0.196D 15	-0.151D 16	0.829D 16
109.00	110.00	110.00	0.128D 15	-0.110D 16	0.724D 16

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=15 M=15 P= 7

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.25	30.50	0.154D 12	0.365D 13	0.780D 14
30.50	30.75	31.00	0.189D 12	0.439D 13	0.918D 14
31.00	31.25	31.50	0.231D 12	0.526D 13	0.108D 15
31.50	31.75	32.00	0.281D 12	0.627D 13	0.126D 15
32.00	32.25	32.50	0.341D 12	0.746D 13	0.146D 15
32.50	32.75	33.00	0.411D 12	0.884D 13	0.170D 15
33.00	33.25	33.50	0.495D 12	0.104D 14	0.196D 15
33.50	33.75	34.00	0.594D 12	0.123D 14	0.226D 15
34.00	34.25	34.50	0.710D 12	0.144D 14	0.260D 15
34.50	34.75	35.00	0.846D 12	0.168D 14	0.297D 15
35.00	35.25	35.50	0.100D 13	0.196D 14	0.339D 15
35.50	35.75	36.00	0.119D 13	0.227D 14	0.386D 15
36.00	36.50	37.00	0.152D 13	0.283D 14	0.465D 15
37.00	37.50	38.00	0.209D 13	0.375D 14	0.591D 15
38.00	38.50	39.00	0.284D 13	0.491D 14	0.742D 15
39.00	39.50	40.00	0.382D 13	0.635D 14	0.922D 15
40.00	40.50	41.00	0.508D 13	0.814D 14	0.113D 16
41.00	41.50	42.00	0.669D 13	0.103D 15	0.138D 16
42.00	42.50	43.00	0.871D 13	0.130D 15	0.166D 16
43.00	43.50	44.00	0.112D 14	0.161D 15	0.198D 16
44.00	44.50	45.00	0.144D 14	0.199D 15	0.234D 16
45.00	45.50	46.00	0.182D 14	0.243D 15	0.273D 16
46.00	46.50	47.00	0.229D 14	0.295D 15	0.316D 16
47.00	47.50	48.00	0.286D 14	0.354D 15	0.363D 16
48.00	48.50	49.00	0.353D 14	0.422D 15	0.413D 16
49.00	49.50	50.00	0.433D 14	0.498D 15	0.465D 16
50.00	51.00	52.00	0.581D 14	0.630D 15	0.547D 16
52.00	53.00	54.00	0.836D 14	0.840D 15	0.656D 16
54.00	55.00	56.00	0.117D 15	0.109D 16	0.758D 16
56.00	58.00	65.00	0.185D 15	0.152D 16	0.870D 16
65.00	66.00	67.00	0.482D 15	0.269D 16	0.660D 16
67.00	68.00	69.00	0.580D 15	0.289D 16	0.453D 16
69.00	70.00	71.00	0.683D 15	0.300D 16	0.186D 16
71.00	72.00	73.00	0.788D 15	0.301D 16	-0.129D 16
73.00	74.00	75.00	0.892D 15	0.291D 16	-0.473D 16
75.00	76.00	77.00	0.990D 15	0.268D 16	-0.825D 16
77.00	78.00	79.00	0.108D 16	0.233D 16	-0.116D 17
79.00	80.00	81.00	0.115D 16	0.188D 16	-0.145D 17
81.00	82.00	83.00	0.121D 16	0.133D 16	-0.168D 17
83.00	84.00	85.00	0.124D 16	0.710D 15	-0.183D 17
85.00	87.00	88.00	0.125D 16	-0.270D 15	-0.188D 17
88.00	89.00	90.00	0.123D 16	-0.911D 15	-0.178D 17
90.00	91.00	92.00	0.119D 16	-0.150D 16	-0.160D 17
92.00	93.00	94.00	0.113D 16	-0.202D 16	-0.134D 17
94.00	95.00	96.00	0.105D 16	-0.244D 16	-0.103D 17
96.00	97.00	98.00	0.961D 15	-0.274D 16	-0.695D 16
98.00	99.00	100.00	0.862D 15	-0.292D 16	-0.350D 16
100.00	101.00	102.00	0.759D 15	-0.299D 16	-0.216D 15
102.00	103.00	104.00	0.655D 15	-0.294D 16	0.270D 16
104.00	105.00	106.00	0.555D 15	-0.280D 16	0.510D 16
106.00	108.00	110.00	0.416D 15	-0.247D 16	0.757D 16
110.00	111.00	111.00	0.298D 15	-0.204D 16	0.865D 16

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=16 M=15 P= 7

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.25	30.50	-0.116D 14	-0.244D 15	-0.451D 16
30.50	30.75	31.00	-0.139D 14	-0.286D 15	-0.517D 16
31.00	31.25	31.50	-0.166D 14	-0.334D 15	-0.589D 16
31.50	31.75	32.00	-0.197D 14	-0.389D 15	-0.669D 16
32.00	32.50	33.00	-0.254D 14	-0.485D 15	-0.804D 16
33.00	33.50	34.00	-0.352D 14	-0.643D 15	-0.101D 17
34.00	34.50	35.00	-0.481D 14	-0.841D 15	-0.126D 17
35.00	35.50	36.00	-0.649D 14	-0.109D 16	-0.155D 17
36.00	36.50	37.00	-0.863D 14	-0.138D 16	-0.188D 17
37.00	37.50	38.00	-0.114D 15	-0.174D 16	-0.224D 17
38.00	38.50	39.00	-0.148D 15	-0.217D 16	-0.265D 17
39.00	39.50	40.00	-0.190D 15	-0.267D 16	-0.308D 17
40.00	40.50	41.00	-0.241D 15	-0.325D 16	-0.355D 17
41.00	41.50	42.00	-0.304D 15	-0.391D 16	-0.403D 17
42.00	43.00	44.00	-0.420D 15	-0.506D 16	-0.476D 17
44.00	45.00	46.00	-0.628D 15	-0.688D 16	-0.566D 17
46.00	47.00	49.00	-0.904D 15	-0.899D 16	-0.636D 17
49.00	51.00	53.00	-0.169D 16	-0.136D 17	-0.645D 17
53.00	54.00	55.00	-0.249D 16	-0.166D 17	-0.476D 17
55.00	56.00	57.00	-0.309D 16	-0.179D 17	-0.261D 17
57.00	58.00	59.00	-0.373D 16	-0.183D 17	0.324D 16
59.00	60.00	60.50	-0.436D 16	-0.176D 17	0.392D 17
60.50	61.00	61.50	-0.466D 16	-0.168D 17	0.589D 17
61.50	62.00	62.50	-0.494D 16	-0.155D 17	0.793D 17
62.50	63.00	63.50	-0.520D 16	-0.140D 17	0.999D 17
63.50	64.00	64.50	-0.543D 16	-0.121D 17	0.120D 18
64.50	65.00	65.50	-0.562D 16	-0.979D 16	0.140D 18
65.50	66.00	66.50	-0.576D 16	-0.719D 16	0.158D 18
66.50	67.00	67.25	-0.587D 16	-0.428D 16	0.174D 18
67.25	67.50	67.75	-0.590D 16	-0.273D 16	0.182D 18
67.75	68.00	68.12	-0.591D 16	-0.112D 16	0.188D 18
68.12	68.25	68.31	-0.592D 16	-0.288D 15	0.191D 18
68.31	68.37	68.50	-0.592D 16	0.131D 15	0.193D 18
68.50	68.62	69.00	-0.591D 16	0.979D 15	0.196D 18
69.00	69.50	70.00	-0.588D 16	0.403D 16	0.204D 18
70.00	72.00	74.00	-0.550D 16	0.132D 17	0.212D 18
74.00	75.00	76.00	-0.453D 16	0.239D 17	0.189D 18
76.00	77.00	78.00	-0.358D 16	0.299D 17	0.154D 18
78.00	79.00	80.00	-0.246D 16	0.345D 17	0.107D 18
80.00	81.00	82.00	-0.120D 16	0.372D 17	0.503D 17
82.00	83.00	84.00	0.120D 15	0.379D 17	-0.103D 17
84.00	85.00	86.00	0.143D 16	0.365D 17	-0.695D 17
86.00	87.00	88.00	0.265D 16	0.332D 17	-0.122D 18
88.00	89.00	90.00	0.372D 16	0.281D 17	-0.164D 18
90.00	91.00	92.00	0.460D 16	0.219D 17	-0.192D 18
92.00	95.00	95.50	0.564D 16	0.775D 16	-0.202D 18
95.50	96.00	96.50	0.574D 16	0.428D 16	-0.195D 18
96.50	97.00	97.12	0.579D 16	0.947D 15	-0.186D 18
97.12	97.25	97.37	0.579D 16	0.143D 15	-0.183D 18
97.37	97.50	97.75	0.579D 16	-0.648D 15	-0.180D 18
97.75	98.00	98.50	0.577D 16	-0.219D 16	-0.173D 18
98.50	99.00	99.50	0.571D 16	-0.509D 16	-0.159D 18
99.50	100.00	100.50	0.560D 16	-0.772D 16	-0.142D 18
100.50	101.00	101.50	0.544D 16	-0.100D 17	-0.124D 18
101.50	102.00	102.50	0.525D 16	-0.120D 17	-0.106D 18
102.50	103.00	103.50	0.502D 16	-0.137D 17	-0.865D 17
103.50	104.00	104.50	0.477D 16	-0.151D 17	-0.675D 17
104.50	105.00	106.00	0.450D 16	-0.161D 17	-0.489D 17
106.00	107.00	108.00	0.392D 16	-0.172D 17	-0.147D 17
108.00	109.00	110.00	0.331D 16	-0.172D 17	0.140D 17
110.00	111.00	111.00	0.273D 16	-0.163D 17	0.358D 17

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=16 M=15 P= 8

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
30.00	30.25	30.50	-0.111D 13	-0.280D 14	-0.636D 15
30.50	30.75	31.00	-0.138D 13	-0.340D 14	-0.756D 15
31.00	31.25	31.50	-0.171D 13	-0.412D 14	-0.896D 15
31.50	31.75	32.00	-0.210D 13	-0.497D 14	-0.106D 16
32.00	32.25	32.50	-0.258D 13	-0.597D 14	-0.124D 16
32.50	32.75	33.00	-0.315D 13	-0.715D 14	-0.146D 16
33.00	33.25	33.50	-0.383D 13	-0.852D 14	-0.170D 16
33.50	33.75	34.00	-0.465D 13	-0.101D 15	-0.197D 16
34.00	34.25	34.50	-0.561D 13	-0.120D 15	-0.228D 16
34.50	34.75	35.00	-0.674D 13	-0.141D 15	-0.263D 16
35.00	35.25	35.50	-0.808D 13	-0.166D 15	-0.303D 16
35.50	35.75	36.00	-0.965D 13	-0.194D 15	-0.347D 16
36.00	36.25	36.50	-0.115D 14	-0.226D 15	-0.396D 16
36.50	36.75	37.00	-0.136D 14	-0.263D 15	-0.450D 16
37.00	37.50	38.00	-0.175D 14	-0.328D 15	-0.543D 16
38.00	38.50	39.00	-0.241D 14	-0.435D 15	-0.689D 16
39.00	39.50	40.00	-0.328D 14	-0.570D 15	-0.863D 16
40.00	40.50	41.00	-0.442D 14	-0.738D 15	-0.107D 17
41.00	41.50	42.00	-0.588D 14	-0.945D 15	-0.131D 17
42.00	42.50	43.00	-0.775D 14	-0.120D 16	-0.158D 17
43.00	43.50	44.00	-0.101D 15	-0.150D 16	-0.189D 17
44.00	44.50	45.00	-0.130D 15	-0.186D 16	-0.223D 17
45.00	45.50	46.00	-0.166D 15	-0.228D 16	-0.260D 17
46.00	46.50	47.00	-0.210D 15	-0.277D 16	-0.301D 17
47.00	47.50	48.00	-0.263D 15	-0.333D 16	-0.343D 17
48.00	48.50	49.00	-0.327D 15	-0.397D 16	-0.387D 17
49.00	50.00	51.00	-0.445D 15	-0.507D 16	-0.453D 17
51.00	52.00	53.00	-0.651D 15	-0.679D 16	-0.535D 17
53.00	55.00	60.00	-0.108D 16	-0.984D 16	-0.618D 17
60.00	61.00	62.00	-0.245D 16	-0.159D 17	-0.454D 17
62.00	63.00	64.00	-0.303D 16	-0.172D 17	-0.258D 17
64.00	65.00	66.00	-0.364D 16	-0.177D 17	0.123D 16
66.00	67.00	68.00	-0.425D 16	-0.170D 17	0.347D 17
68.00	68.50	69.00	-0.468D 16	-0.158D 17	0.628D 17
69.00	69.50	70.00	-0.495D 16	-0.145D 17	0.823D 17
70.00	70.50	71.00	-0.519D 16	-0.129D 17	0.102D 18
71.00	71.50	72.00	-0.540D 16	-0.110D 17	0.121D 18
72.00	72.50	73.00	-0.557D 16	-0.867D 16	0.140D 18
73.00	73.50	74.00	-0.570D 16	-0.608D 16	0.157D 18
74.00	74.50	74.75	-0.578D 16	-0.320D 16	0.172D 18
74.75	75.00	75.25	-0.580D 16	-0.167D 16	0.179D 18
75.25	75.50	75.75	-0.581D 16	-0.729D 14	0.186D 18
75.75	76.00	76.50	-0.580D 16	0.157D 16	0.191D 18
76.50	77.00	78.00	-0.574D 16	0.499D 16	0.200D 18
78.00	80.00	82.00	-0.520D 16	0.157D 17	0.205D 18
82.00	83.00	84.00	-0.411D 16	0.259D 17	0.176D 18
84.00	85.00	86.00	-0.310D 16	0.314D 17	0.138D 18
86.00	87.00	88.00	-0.193D 16	0.353D 17	0.878D 17
88.00	89.00	90.00	-0.656D 15	0.374D 17	0.301D 17
90.00	91.00	92.00	0.656D 15	0.374D 17	-0.301D 17

Table A1 (Continued)

EVALUATION OF INCLINATION FUNCTION FOR L=16 M=15 P= 8

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
92.00	93.00	94.00	0.193D 16	0.353D 17	-0.878D 17
94.00	95.00	96.00	0.310D 16	0.314D 17	-0.138D 18
96.00	97.00	98.00	0.411D 16	0.259D 17	-0.176D 18
98.00	100.00	103.00	0.520D 16	0.157D 17	-0.205D 18
103.00	103.50	103.75	0.578D 16	0.326D 16	-0.196D 18
103.75	104.00	104.25	0.580D 16	0.157D 16	-0.191D 18
104.25	104.50	104.75	0.581D 16	-0.729D 14	-0.186D 18
104.75	105.00	105.50	0.580D 16	-0.167D 16	-0.179D 18
105.50	105.75	106.00	0.576D 16	-0.395D 16	-0.169D 18
106.00	106.50	107.00	0.570D 16	-0.608D 16	-0.157D 18
107.00	107.50	108.00	0.557D 16	-0.867D 16	-0.140D 18
108.00	108.50	109.00	0.540D 16	-0.110D 17	-0.121D 18
109.00	109.50	110.00	0.519D 16	-0.129D 17	-0.102D 18
110.00	110.50	110.50	0.495D 16	-0.145D 17	-0.823D 17

Definition of Symbols Used in Table A2

XLO - Lower value of satellite orbital eccentricity.

XMID - Middle value of satellite orbital eccentricity.

XHI - Higher value of satellite orbital eccentricity.

FXMID - Value of the eccentricity function corresponding to the middle value of eccentricity.

DFXMID - Value of the first derivative of the eccentricity function corresponding to the middle value of eccentricity.

DDFXMID - Value of the second derivative of the eccentricity function corresponding to the middle value of eccentricity.

Table 2

Tables of Eccentricity Function Coefficients for Calculation of the Effects of the Principal Even and Odd Geopotential Coefficients.

EVALUATION OF ECCENTRICITY FUNCTION FOR L=12 P= 5 Q=-1

XLO*	XMID*	XHI*	FXMID	DFXMID	DDFXMID
0.010	0.020	0.030	0.908D-01	0.462D 01	0.122D 02
0.030	0.040	0.050	0.187D 00	0.499D 01	0.253D 02
0.050	0.060	0.070	0.292D 00	0.565D 01	0.405D 02
0.070	0.080	0.090	0.415D 00	0.664D 01	0.590D 02
0.090	0.100	0.110	0.561D 00	0.804D 01	0.826D 02
0.110	0.120	0.130	0.740D 00	0.999D 01	0.113D 03
0.130	0.135	0.140	0.903D 00	0.119D 02	0.143D 03
0.140	0.145	0.150	0.103D 01	0.135D 02	0.167D 03
0.150	0.155	0.160	0.117D 01	0.153D 02	0.195D 03
0.160	0.165	0.170	0.134D 01	0.174D 02	0.228D 03
0.170	0.175	0.180	0.152D 01	0.198D 02	0.267D 03
0.180	0.185	0.190	0.173D 01	0.227D 02	0.312D 03
0.190	0.195	0.200	0.198D 01	0.261D 02	0.366D 03
0.200	0.205	0.210	0.226D 01	0.301D 02	0.430D 03
0.210	0.215	0.220	0.258D 01	0.348D 02	0.506D 03
0.220	0.225	0.230	0.296D 01	0.402D 02	0.596D 03
0.230	0.235	0.240	0.339D 01	0.467D 02	0.704D 03
0.240	0.245	0.250	0.390D 01	0.544D 02	0.834D 03
0.250	0.255	0.255	0.448D 01	0.635D 02	0.990D 03

*Values of eccentricity.

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=12 P= 5 Q= 0

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.015	0.020	0.101D 01	0.106D 01	0.712D 02
0.020	0.025	0.030	0.102D 01	0.178D 01	0.733D 02
0.030	0.040	0.050	0.106D 01	0.291D 01	0.785D 02
0.050	0.060	0.070	0.113D 01	0.459D 01	0.899D 02
0.070	0.080	0.090	0.124D 01	0.655D 01	0.107D 03
0.090	0.100	0.110	0.140D 01	0.892D 01	0.132D 03
0.110	0.120	0.130	0.160D 01	0.119D 02	0.167D 03
0.130	0.140	0.150	0.188D 01	0.157D 02	0.215D 03
0.150	0.155	0.160	0.214D 01	0.193D 02	0.263D 03
0.160	0.165	0.170	0.235D 01	0.221D 02	0.302D 03
0.170	0.175	0.180	0.258D 01	0.253D 02	0.348D 03
0.180	0.185	0.190	0.285D 01	0.291D 02	0.403D 03
0.190	0.195	0.200	0.317D 01	0.334D 02	0.467D 03
0.200	0.205	0.210	0.352D 01	0.385D 02	0.543D 03
0.210	0.215	0.220	0.394D 01	0.443D 02	0.634D 03
0.220	0.225	0.230	0.441D 01	0.512D 02	0.741D 03
0.230	0.235	0.240	0.497D 01	0.592D 02	0.870D 03
0.240	0.245	0.250	0.560D 01	0.687D 02	0.102D 04
0.250	0.255	0.260	0.634D 01	0.798D 02	0.121D 04
0.260	0.265	0.270	0.721D 01	0.929D 02	0.143D 04
0.270	0.275	0.280	0.821D 01	0.108D 03	0.169D 04
0.280	0.285	0.290	0.939D 01	0.127D 03	0.201D 04
0.290	0.295	0.300	0.108D 02	0.149D 03	0.240D 04
0.300	0.305	0.310	0.124D 02	0.175D 03	0.287D 04
0.310	0.315	0.320	0.143D 02	0.207D 03	0.345D 04
0.320	0.325	0.330	0.165D 02	0.245D 03	0.415D 04
0.330	0.335	0.340	0.192D 02	0.290D 03	0.501D 04
0.340	0.345	0.350	0.224D 02	0.345D 03	0.607D 04
0.350	0.355	0.360	0.262D 02	0.412D 03	0.738D 04
0.360	0.365	0.370	0.307D 02	0.494D 03	0.899D 04
0.370	0.375	0.380	0.361D 02	0.594D 03	0.110D 05
0.380	0.385	0.390	0.426D 02	0.716D 03	0.135D 05
0.390	0.395	0.400	0.505D 02	0.866D 03	0.167D 05
0.400	0.405	0.410	0.601D 02	0.105D 04	0.206D 05
0.410	0.415	0.420	0.717D 02	0.128D 04	0.256D 05
0.420	0.425	0.430	0.859D 02	0.157D 04	0.319D 05
0.430	0.435	0.440	0.103D 03	0.192D 04	0.398D 05
0.440	0.445	0.450	0.125D 03	0.237D 04	0.500D 05
0.450	0.455	0.460	0.151D 03	0.293D 04	0.631D 05
0.460	0.465	0.470	0.184D 03	0.365D 04	0.799D 05
0.470	0.475	0.480	0.225D 03	0.455D 04	0.102D 06
0.480	0.485	0.490	0.276D 03	0.570D 04	0.130D 06
0.490	0.495	0.500	0.340D 03	0.717D 04	0.166D 06
0.500	0.505	0.505	0.420D 03	0.906D 04	0.214D 06

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=12 P= 6 Q= 1

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.020	0.030	0.131D 00	0.668D 01	0.177D 02
0.030	0.040	0.050	0.269D 00	0.722D 01	0.368D 02
0.050	0.060	0.070	0.423D 00	0.817D 01	0.589D 02
0.070	0.080	0.090	0.599D 00	0.960D 01	0.859D 02
0.090	0.100	0.110	0.811D 00	0.116D 02	0.120D 03
0.110	0.120	0.130	0.107D 01	0.145D 02	0.165D 03
0.130	0.135	0.140	0.131D 01	0.173D 02	0.209D 03
0.140	0.145	0.150	0.149D 01	0.195D 02	0.243D 03
0.150	0.155	0.160	0.170D 01	0.222D 02	0.284D 03
0.160	0.165	0.170	0.194D 01	0.252D 02	0.332D 03
0.170	0.175	0.180	0.221D 01	0.288D 02	0.388D 03
0.180	0.185	0.190	0.251D 01	0.330D 02	0.455D 03
0.190	0.195	0.200	0.287D 01	0.380D 02	0.533D 03
0.200	0.205	0.210	0.328D 01	0.437D 02	0.626D 03
0.210	0.215	0.220	0.375D 01	0.505D 02	0.737D 03
0.220	0.225	0.230	0.429D 01	0.586D 02	0.869D 03
0.230	0.235	0.240	0.492D 01	0.680D 02	0.103D 04
0.240	0.245	0.250	0.566D 01	0.792D 02	0.122D 04
0.250	0.255	0.255	0.651D 01	0.925D 02	0.144D 04

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=13 P= 5 Q=-1

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.020	0.030	0.808D-01	0.412D 01	0.119D 02
0.030	0.040	0.050	0.166D 00	0.448D 01	0.248D 02
0.050	0.060	0.070	0.262D 00	0.512D 01	0.399D 02
0.070	0.080	0.090	0.374D 00	0.610D 01	0.587D 02
0.090	0.100	0.110	0.509D 00	0.751D 01	0.829D 02
0.110	0.115	0.120	0.632D 00	0.892D 01	0.106D 03
0.120	0.125	0.130	0.726D 00	0.101D 02	0.125D 03
0.130	0.135	0.140	0.834D 00	0.114D 02	0.147D 03
0.140	0.145	0.150	0.956D 00	0.130D 02	0.173D 03
0.150	0.155	0.160	0.110D 01	0.149D 02	0.203D 03
0.160	0.165	0.170	0.125D 01	0.171D 02	0.239D 03
0.170	0.175	0.180	0.144D 01	0.197D 02	0.282D 03
0.180	0.185	0.190	0.165D 01	0.228D 02	0.333D 03
0.190	0.195	0.200	0.190D 01	0.264D 02	0.394D 03
0.200	0.205	0.210	0.218D 01	0.307D 02	0.467D 03
0.210	0.215	0.220	0.251D 01	0.358D 02	0.554D 03
0.220	0.225	0.230	0.290D 01	0.418D 02	0.659D 03
0.230	0.235	0.240	0.335D 01	0.490D 02	0.787D 03
0.240	0.245	0.250	0.389D 01	0.577D 02	0.941D 03
0.250	0.255	0.260	0.451D 01	0.680D 02	0.113D 04
0.260	0.265	0.270	0.525D 01	0.804D 02	0.136D 04
0.270	0.275	0.280	0.613D 01	0.953D 02	0.163D 04
0.280	0.285	0.290	0.717D 01	0.113D 03	0.198D 04
0.290	0.295	0.300	0.841D 01	0.135D 03	0.240D 04
0.300	0.305	0.310	0.988D 01	0.162D 03	0.291D 04
0.310	0.315	0.320	0.117D 02	0.194D 03	0.356D 04
0.320	0.325	0.330	0.138D 02	0.233D 03	0.435D 04
0.330	0.335	0.340	0.163D 02	0.281D 03	0.534D 04
0.340	0.345	0.350	0.194D 02	0.341D 03	0.659D 04
0.350	0.355	0.360	0.232D 02	0.414D 03	0.814D 04
0.360	0.365	0.370	0.278D 02	0.505D 03	0.101D 05
0.370	0.375	0.380	0.334D 02	0.618D 03	0.126D 05
0.380	0.385	0.390	0.402D 02	0.759D 03	0.157D 05
0.390	0.395	0.400	0.487D 02	0.935D 03	0.197D 05
0.400	0.405	0.410	0.591D 02	0.116D 04	0.249D 05
0.410	0.415	0.420	0.720D 02	0.144D 04	0.314D 05
0.420	0.425	0.430	0.881D 02	0.179D 04	0.399D 05
0.430	0.435	0.440	0.108D 03	0.224D 04	0.509D 05
0.440	0.445	0.450	0.133D 03	0.282D 04	0.651D 05
0.450	0.455	0.460	0.165D 03	0.356D 04	0.837D 05
0.460	0.465	0.470	0.205D 03	0.451D 04	0.108D 06
0.470	0.475	0.480	0.256D 03	0.575D 04	0.140D 06
0.480	0.485	0.490	0.322D 03	0.735D 04	0.183D 06
0.490	0.495	0.500	0.405D 03	0.945D 04	0.239D 06
0.500	0.505	0.505	0.513D 03	0.122D 05	0.314D 06

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=13 P= 6 Q= 0

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.015	0.020	0.101D 01	0.134D 01	0.908D 02
0.020	0.025	0.030	0.103D 01	0.227D 01	0.940D 02
0.030	0.035	0.040	0.106D 01	0.323D 01	0.989D 02
0.040	0.045	0.050	0.109D 01	0.425D 01	0.106D 03
0.050	0.055	0.060	0.114D 01	0.535D 01	0.114D 03
0.060	0.065	0.070	0.120D 01	0.655D 01	0.125D 03
0.070	0.075	0.080	0.127D 01	0.787D 01	0.139D 03
0.080	0.085	0.090	0.136D 01	0.934D 01	0.155D 03
0.090	0.095	0.100	0.146D 01	0.110D 02	0.175D 03
0.100	0.105	0.110	0.158D 01	0.129D 02	0.199D 03
0.110	0.115	0.120	0.172D 01	0.150D 02	0.227D 03
0.120	0.125	0.130	0.188D 01	0.174D 02	0.261D 03
0.130	0.135	0.140	0.207D 01	0.202D 02	0.301D 03
0.140	0.145	0.150	0.229D 01	0.235D 02	0.349D 03
0.150	0.155	0.160	0.254D 01	0.272D 02	0.405D 03
0.160	0.165	0.170	0.283D 01	0.316D 02	0.473D 03
0.170	0.175	0.180	0.317D 01	0.367D 02	0.554D 03
0.180	0.185	0.190	0.357D 01	0.427D 02	0.650D 03
0.190	0.195	0.200	0.403D 01	0.498D 02	0.766D 03

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=13 P= 6 Q= 1

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.020	0.030	0.162D 00	0.824D 01	0.239D 02
0.030	0.040	0.050	0.333D 00	0.897D 01	0.500D 02
0.050	0.060	0.070	0.524D 00	0.103D 02	0.804D 02
0.070	0.080	0.090	0.748D 00	0.122D 02	0.118D 03
0.090	0.100	0.110	0.102D 01	0.151D 02	0.167D 03
0.110	0.115	0.120	0.127D 01	0.179D 02	0.214D 03
0.120	0.125	0.130	0.146D 01	0.202D 02	0.252D 03
0.130	0.135	0.140	0.167D 01	0.230D 02	0.297D 03
0.140	0.145	0.150	0.192D 01	0.262D 02	0.349D 03
0.150	0.155	0.160	0.220D 01	0.300D 02	0.410D 03
0.160	0.165	0.170	0.252D 01	0.345D 02	0.483D 03
0.170	0.175	0.180	0.289D 01	0.397D 02	0.570D 03
0.180	0.185	0.190	0.332D 01	0.459D 02	0.673D 03
0.190	0.195	0.200	0.381D 01	0.532D 02	0.796D 03
0.200	0.205	0.210	0.439D 01	0.619D 02	0.943D 03
0.210	0.215	0.220	0.506D 01	0.722D 02	0.112D 04
0.220	0.225	0.230	0.584D 01	0.844D 02	0.133D 04
0.230	0.235	0.240	0.675D 01	0.990D 02	0.159D 04
0.240	0.245	0.250	0.783D 01	0.116D 03	0.190D 04
0.250	0.255	0.260	0.909D 01	0.137D 03	0.228D 04
0.260	0.265	0.270	0.106D 02	0.162D 03	0.274D 04
0.270	0.275	0.280	0.124D 02	0.192D 03	0.331D 04
0.280	0.285	0.290	0.145D 02	0.229D 03	0.400D 04
0.290	0.295	0.300	0.170D 02	0.273D 03	0.485D 04
0.300	0.305	0.310	0.199D 02	0.326D 03	0.589D 04
0.310	0.315	0.320	0.235D 02	0.392D 03	0.719D 04
0.320	0.325	0.330	0.278D 02	0.471D 03	0.880D 04
0.330	0.335	0.340	0.330D 02	0.569D 03	0.108D 05
0.340	0.345	0.350	0.393D 02	0.689D 03	0.133D 05
0.350	0.355	0.360	0.469D 02	0.837D 03	0.165D 05
0.360	0.365	0.370	0.561D 02	0.102D 04	0.204D 05
0.370	0.375	0.380	0.675D 02	0.125D 04	0.254D 05
0.380	0.385	0.390	0.813D 02	0.153D 04	0.318D 05
0.390	0.395	0.400	0.984D 02	0.189D 04	0.399D 05
0.400	0.405	0.410	0.119D 03	0.234D 04	0.502D 05
0.410	0.415	0.420	0.146D 03	0.290D 04	0.635D 05
0.420	0.425	0.430	0.178D 03	0.362D 04	0.806D 05
0.430	0.435	0.440	0.219D 03	0.453D 04	0.103D 06
0.440	0.445	0.450	0.270D 03	0.570D 04	0.131D 06
0.450	0.455	0.460	0.334D 03	0.719D 04	0.169D 06
0.460	0.465	0.470	0.415D 03	0.911D 04	0.218D 06
0.470	0.475	0.480	0.518D 03	0.116D 05	0.283D 06
0.480	0.485	0.490	0.649D 03	0.148D 05	0.368D 06
0.490	0.495	0.500	0.818D 03	0.191D 05	0.482D 06
0.500	0.505	0.505	0.103D 04	0.246D 05	0.633D 06

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=14 P= 6 Q=-1

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.020	0.030	0.111D 00	0.570D 01	0.198D 02
0.030	0.040	0.050	0.231D 00	0.630D 01	0.416D 02
0.050	0.055	0.060	0.331D 00	0.707D 01	0.606D 02
0.060	0.065	0.070	0.404D 00	0.775D 01	0.752D 02
0.070	0.075	0.080	0.486D 00	0.858D 01	0.918D 02
0.080	0.085	0.090	0.577D 00	0.959D 01	0.111D 03
0.090	0.095	0.100	0.678D 00	0.108D 02	0.133D 03
0.100	0.105	0.110	0.794D 00	0.123D 02	0.159D 03
0.110	0.115	0.120	0.925D 00	0.140D 02	0.189D 03
0.120	0.125	0.130	0.107D 01	0.161D 02	0.225D 03
0.130	0.135	0.140	0.125D 01	0.185D 02	0.268D 03
0.140	0.145	0.150	0.145D 01	0.215D 02	0.319D 03
0.150	0.155	0.160	0.168D 01	0.249D 02	0.380D 03
0.160	0.165	0.170	0.195D 01	0.291D 02	0.453D 03

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=14 P= 6 Q= 0

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.015	0.020	0.101D 01	0.147D 01	0.991D 02
0.020	0.025	0.030	0.103D 01	0.247D 01	0.103D 03
0.030	0.035	0.040	0.106D 01	0.353D 01	0.109D 03
0.040	0.045	0.050	0.110D 01	0.466D 01	0.117D 03
0.050	0.055	0.060	0.115D 01	0.588D 01	0.127D 03
0.060	0.065	0.070	0.122D 01	0.722D 01	0.141D 03
0.070	0.075	0.080	0.130D 01	0.870D 01	0.157D 03
0.080	0.085	0.090	0.139D 01	0.104D 02	0.177D 03
0.090	0.095	0.100	0.151D 01	0.123D 02	0.201D 03
0.100	0.105	0.110	0.164D 01	0.144D 02	0.231D 03
0.110	0.115	0.120	0.180D 01	0.169D 02	0.266D 03
0.120	0.125	0.130	0.198D 01	0.198D 02	0.308D 03
0.130	0.135	0.140	0.219D 01	0.231D 02	0.358D 03
0.140	0.145	0.150	0.244D 01	0.269D 02	0.418D 03
0.150	0.155	0.160	0.273D 01	0.315D 02	0.491D 03
0.160	0.165	0.170	0.308D 01	0.368D 02	0.578D 03
0.170	0.175	0.180	0.347D 01	0.431D 02	0.683D 03
0.180	0.185	0.190	0.394D 01	0.505D 02	0.810D 03
0.190	0.195	0.200	0.449D 01	0.594D 02	0.963D 03
0.200	0.205	0.210	0.513D 01	0.699D 02	0.115D 04
0.210	0.215	0.220	0.589D 01	0.825D 02	0.137D 04
0.220	0.225	0.230	0.679D 01	0.975D 02	0.165D 04
0.230	0.235	0.240	0.786D 01	0.116D 03	0.198D 04
0.240	0.245	0.250	0.912D 01	0.137D 03	0.239D 04
0.250	0.255	0.260	0.106D 02	0.164D 03	0.290D 04
0.260	0.265	0.270	0.124D 02	0.196D 03	0.352D 04
0.270	0.275	0.280	0.146D 02	0.235D 03	0.429D 04
0.280	0.285	0.290	0.171D 02	0.282D 03	0.525D 04
0.290	0.295	0.300	0.202D 02	0.340D 03	0.644D 04
0.300	0.305	0.310	0.240D 02	0.412D 03	0.792D 04
0.310	0.315	0.320	0.285D 02	0.500D 03	0.978D 04
0.320	0.325	0.330	0.341D 02	0.609D 03	0.121D 05
0.330	0.335	0.340	0.408D 02	0.744D 03	0.151D 05
0.340	0.345	0.350	0.491D 02	0.913D 03	0.188D 05
0.350	0.355	0.360	0.592D 02	0.112D 04	0.235D 05
0.360	0.365	0.370	0.717D 02	0.139D 04	0.296D 05
0.370	0.375	0.380	0.872D 02	0.172D 04	0.373D 05
0.380	0.385	0.390	0.106D 03	0.214D 04	0.473D 05
0.390	0.395	0.400	0.130D 03	0.268D 04	0.601D 05
0.400	0.405	0.410	0.160D 03	0.336D 04	0.767D 05
0.410	0.415	0.420	0.198D 03	0.423D 04	0.983D 05
0.420	0.425	0.430	0.246D 03	0.534D 04	0.126D 06
0.430	0.435	0.440	0.306D 03	0.678D 04	0.163D 06
0.440	0.445	0.450	0.383D 03	0.865D 04	0.212D 06

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=14 P= 7 Q= 1

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.020	0.030	0.152D 00	0.777D 01	0.271D 02
0.030	0.040	0.050	0.315D 00	0.860D 01	0.570D 02
0.050	0.055	0.060	0.451D 00	0.965D 01	0.831D 02
0.060	0.065	0.070	0.552D 00	0.106D 02	0.103D 03
0.070	0.075	0.080	0.663D 00	0.117D 02	0.126D 03
0.080	0.085	0.090	0.787D 00	0.131D 02	0.152D 03
0.090	0.095	0.100	0.926D 00	0.148D 02	0.183D 03
0.100	0.105	0.110	0.108D 01	0.168D 02	0.218D 03
0.110	0.115	0.120	0.126D 01	0.192D 02	0.260D 03
0.120	0.125	0.130	0.147D 01	0.220D 02	0.309D 03
0.130	0.135	0.140	0.171D 01	0.254D 02	0.368D 03
0.140	0.145	0.150	0.198D 01	0.294D 02	0.438D 03
0.150	0.155	0.160	0.230D 01	0.342D 02	0.522D 03
0.160	0.165	0.170	0.267D 01	0.399D 02	0.623D 03

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=15 P= 6 Q=-1

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.020	0.030	0.101D 00	0.519D 01	0.196D 02
0.030	0.035	0.040	0.182D 00	0.561D 01	0.356D 02
0.040	0.045	0.050	0.240D 00	0.602D 01	0.474D 02
0.050	0.055	0.060	0.303D 00	0.656D 01	0.606D 02
0.060	0.065	0.070	0.372D 00	0.724D 01	0.755D 02
0.070	0.075	0.080	0.448D 00	0.808D 01	0.926D 02
0.080	0.085	0.090	0.534D 00	0.910D 01	0.112D 03
0.090	0.095	0.100	0.631D 00	0.103D 02	0.136D 03
0.100	0.105	0.110	0.741D 00	0.118D 02	0.163D 03
0.110	0.115	0.120	0.868D 00	0.136D 02	0.196D 03
0.120	0.125	0.130	0.101D 01	0.158D 02	0.234D 03
0.130	0.135	0.140	0.118D 01	0.183D 02	0.281D 03
0.140	0.145	0.150	0.138D 01	0.214D 02	0.337D 03
0.150	0.155	0.160	0.161D 01	0.251D 02	0.404D 03
0.160	0.165	0.170	0.189D 01	0.295D 02	0.486D 03
0.170	0.175	0.180	0.221D 01	0.349D 02	0.586D 03
0.180	0.185	0.190	0.259D 01	0.413D 02	0.707D 03
0.190	0.195	0.200	0.304D 01	0.491D 02	0.856D 03
0.200	0.205	0.210	0.358D 01	0.585D 02	0.104D 04
0.210	0.215	0.220	0.422D 01	0.700D 02	0.126D 04
0.220	0.225	0.230	0.498D 01	0.840D 02	0.154D 04
0.230	0.235	0.240	0.591D 01	0.101D 03	0.188D 04
0.240	0.245	0.250	0.702D 01	0.122D 03	0.231D 04
0.250	0.255	0.260	0.836D 01	0.148D 03	0.284D 04
0.260	0.265	0.270	0.999D 01	0.179D 03	0.351D 04
0.270	0.275	0.280	0.120D 02	0.218D 03	0.434D 04
0.280	0.285	0.290	0.144D 02	0.267D 03	0.539D 04
0.290	0.295	0.300	0.173D 02	0.327D 03	0.672D 04
0.300	0.305	0.310	0.210D 02	0.402D 03	0.841D 04
0.310	0.315	0.320	0.255D 02	0.497D 03	0.105D 05
0.320	0.325	0.330	0.310D 02	0.615D 03	0.133D 05
0.330	0.335	0.340	0.379D 02	0.765D 03	0.168D 05
0.340	0.345	0.350	0.464D 02	0.955D 03	0.213D 05
0.350	0.355	0.360	0.571D 02	0.120D 04	0.272D 05
0.360	0.365	0.370	0.706D 02	0.150D 04	0.347D 05
0.370	0.375	0.380	0.875D 02	0.190D 04	0.446D 05
0.380	0.385	0.390	0.109D 03	0.241D 04	0.575D 05
0.390	0.395	0.400	0.136D 03	0.306D 04	0.744D 05
0.400	0.405	0.410	0.171D 03	0.391D 04	0.967D 05
0.410	0.415	0.420	0.215D 03	0.502D 04	0.126D 06
0.420	0.425	0.430	0.272D 03	0.647D 04	0.165D 06
0.430	0.435	0.440	0.346D 03	0.837D 04	0.218D 06
0.440	0.442	0.445	0.415D 03	0.102D 05	0.268D 06
0.445	0.447	0.450	0.470D 03	0.116D 05	0.309D 06

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=15 P= 7 Q= 0

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.015	0.020	0.101D 01	0.179D 01	0.121D 03
0.020	0.025	0.030	0.104D 01	0.302D 01	0.127D 03
0.030	0.035	0.040	0.107D 01	0.433D 01	0.135D 03
0.040	0.045	0.050	0.112D 01	0.573D 01	0.147D 03
0.050	0.055	0.060	0.119D 01	0.727D 01	0.162D 03
0.060	0.065	0.070	0.127D 01	0.898D 01	0.181D 03
0.070	0.075	0.080	0.137D 01	0.109D 02	0.205D 03
0.080	0.085	0.090	0.149D 01	0.131D 02	0.235D 03
0.090	0.095	0.100	0.163D 01	0.156D 02	0.271D 03
0.100	0.105	0.110	0.180D 01	0.186D 02	0.315D 03
0.110	0.115	0.120	0.201D 01	0.220D 02	0.369D 03

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=15 P= 7 Q= 1

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.015	0.020	0.136D 00	0.920D 01	0.264D 02
0.020	0.025	0.030	0.230D 00	0.955D 01	0.449D 02
0.030	0.035	0.040	0.328D 00	0.101D 02	0.646D 02
0.040	0.045	0.050	0.432D 00	0.109D 02	0.861D 02
0.050	0.055	0.060	0.545D 00	0.118D 02	0.110D 03
0.060	0.065	0.070	0.670D 00	0.131D 02	0.137D 03
0.070	0.075	0.080	0.808D 00	0.146D 02	0.168D 03
0.080	0.085	0.090	0.962D 00	0.164D 02	0.204D 03
0.090	0.095	0.100	0.114D 01	0.187D 02	0.246D 03
0.100	0.105	0.110	0.134D 01	0.214D 02	0.296D 03
0.110	0.115	0.120	0.157D 01	0.246D 02	0.355D 03
0.120	0.125	0.130	0.183D 01	0.285D 02	0.426D 03
0.130	0.135	0.140	0.214D 01	0.332D 02	0.511D 03
0.140	0.145	0.150	0.250D 01	0.388D 02	0.613D 03
0.150	0.155	0.160	0.292D 01	0.455D 02	0.736D 03
0.160	0.165	0.170	0.342D 01	0.536D 02	0.885D 03
0.170	0.175	0.180	0.400D 01	0.633D 02	0.107D 04
0.180	0.185	0.190	0.469D 01	0.751D 02	0.129D 04
0.190	0.195	0.200	0.551D 01	0.893D 02	0.156D 04
0.200	0.205	0.210	0.648D 01	0.106D 03	0.189D 04
0.210	0.215	0.220	0.765D 01	0.127D 03	0.230D 04
0.220	0.225	0.230	0.905D 01	0.153D 03	0.281D 04
0.230	0.235	0.240	0.107D 02	0.184D 03	0.343D 04
0.240	0.245	0.250	0.127D 02	0.222D 03	0.421D 04
0.250	0.255	0.260	0.152D 02	0.269D 03	0.518D 04
0.260	0.265	0.270	0.182D 02	0.326D 03	0.640D 04
0.270	0.275	0.280	0.218D 02	0.398D 03	0.792D 04
0.280	0.285	0.290	0.262D 02	0.486D 03	0.984D 04
0.290	0.295	0.300	0.316D 02	0.596D 03	0.123D 05
0.300	0.305	0.310	0.382D 02	0.734D 03	0.153D 05
0.310	0.315	0.320	0.464D 02	0.906D 03	0.193D 05
0.320	0.325	0.330	0.565D 02	0.112D 04	0.243D 05
0.330	0.335	0.340	0.690D 02	0.140D 04	0.307D 05
0.340	0.345	0.350	0.846D 02	0.174D 04	0.389D 05
0.350	0.355	0.360	0.104D 03	0.218D 04	0.496D 05
0.360	0.365	0.370	0.129D 03	0.274D 04	0.634D 05
0.370	0.375	0.380	0.160D 03	0.346D 04	0.814D 05
0.380	0.385	0.390	0.199D 03	0.439D 04	0.105D 06
0.390	0.395	0.400	0.248D 03	0.559D 04	0.136D 06
0.400	0.405	0.410	0.312D 03	0.714D 04	0.177D 06
0.410	0.415	0.420	0.393D 03	0.916D 04	0.230D 06
0.420	0.425	0.430	0.497D 03	0.118D 05	0.302D 06
0.430	0.435	0.440	0.632D 03	0.153D 05	0.397D 06
0.440	0.442	0.445	0.758D 03	0.186D 05	0.490D 06
0.445	0.447	0.450	0.858D 03	0.212D 05	0.564D 06

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=16 P= 7 Q=-1

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.015	0.020	0.983D-01	0.667D 01	0.223D 02
0.020	0.025	0.030	0.166D 00	0.697D 01	0.380D 02
0.030	0.035	0.040	0.238D 00	0.743D 01	0.548D 02
0.040	0.045	0.050	0.316D 00	0.807D 01	0.735D 02
0.050	0.055	0.060	0.400D 00	0.891D 01	0.945D 02
0.060	0.065	0.070	0.494D 00	0.997D 01	0.119D 03
0.070	0.075	0.080	0.601D 00	0.113D 02	0.147D 03

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=16 P= 7 Q= 0

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.015	0.020	0.101D 01	0.194D 01	0.132D 03
0.020	0.025	0.030	0.104D 01	0.328D 01	0.138D 03
0.030	0.035	0.040	0.108D 01	0.471D 01	0.148D 03
0.040	0.045	0.050	0.114D 01	0.626D 01	0.162D 03
0.050	0.055	0.060	0.121D 01	0.796D 01	0.180D 03
0.060	0.065	0.070	0.129D 01	0.987D 01	0.203D 03
0.070	0.075	0.080	0.140D 01	0.120D 02	0.232D 03
0.080	0.085	0.090	0.154D 01	0.145D 02	0.268D 03
0.090	0.095	0.100	0.170D 01	0.174D 02	0.312D 03
0.100	0.105	0.110	0.189D 01	0.208D 02	0.365D 03
0.110	0.115	0.120	0.211D 01	0.248D 02	0.431D 03
0.120	0.125	0.130	0.238D 01	0.295D 02	0.512D 03
0.130	0.135	0.140	0.271D 01	0.351D 02	0.610D 03
0.140	0.145	0.150	0.309D 01	0.417D 02	0.730D 03
0.150	0.155	0.160	0.355D 01	0.497D 02	0.877D 03
0.160	0.165	0.170	0.409D 01	0.594D 02	0.106D 04
0.170	0.175	0.180	0.474D 01	0.711D 02	0.128D 04
0.180	0.185	0.190	0.552D 01	0.852D 02	0.156D 04
0.190	0.195	0.200	0.645D 01	0.102D 03	0.190D 04
0.200	0.205	0.210	0.758D 01	0.123D 03	0.232D 04
0.210	0.215	0.220	0.894D 01	0.149D 03	0.284D 04
0.220	0.225	0.230	0.106D 02	0.181D 03	0.350D 04
0.230	0.235	0.240	0.126D 02	0.220D 03	0.432D 04
0.240	0.245	0.250	0.150D 02	0.268D 03	0.535D 04
0.250	0.255	0.260	0.180D 02	0.328D 03	0.666D 04
0.260	0.265	0.270	0.216D 02	0.402D 03	0.830D 04
0.270	0.275	0.280	0.261D 02	0.495D 03	0.104D 05
0.280	0.285	0.290	0.316D 02	0.612D 03	0.131D 05
0.290	0.295	0.300	0.384D 02	0.759D 03	0.165D 05
0.300	0.305	0.310	0.469D 02	0.944D 03	0.208D 05
0.310	0.315	0.320	0.575D 02	0.118D 04	0.265D 05
0.320	0.325	0.330	0.707D 02	0.148D 04	0.337D 05
0.330	0.335	0.340	0.873D 02	0.186D 04	0.432D 05
0.340	0.345	0.350	0.108D 03	0.235D 04	0.555D 05
0.350	0.355	0.360	0.135D 03	0.298D 04	0.716D 05
0.360	0.365	0.370	0.169D 03	0.380D 04	0.926D 05
0.370	0.375	0.380	0.212D 03	0.486D 04	0.120D 06
0.380	0.385	0.390	0.267D 03	0.624D 04	0.157D 06
0.390	0.395	0.400	0.338D 03	0.804D 04	0.206D 06

Table A2 (Continued)

EVALUATION OF ECCENTRICITY FUNCTION FOR L=16 P= 8 Q= 1

XLO	XMID	XHI	FXMID	DFXMID	DDFXMID
0.010	0.015	0.020	0.129D 00	0.872D 01	0.293D 02
0.020	0.025	0.030	0.218D 00	0.911D 01	0.499D 02
0.030	0.035	0.040	0.312D 00	0.972D 01	0.721D 02
0.040	0.045	0.050	0.413D 00	0.106D 02	0.965D 02
0.050	0.055	0.060	0.524D 00	0.117D 02	0.124D 03
0.060	0.065	0.070	0.647D 00	0.131D 02	0.156D 03
0.070	0.075	0.080	0.786D 00	0.148D 02	0.193D 03